JANUARY
1960

FOUNDRY

A PENTON PUBLICATION

10% UPTURN IN 1960

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A New Triumph of Carborundum

BEST DEOXIDIZER EVER!

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Out of Carborundum's laboratories—thoroughly tested under the most rigorous foundry conditions—comes an improved cupola deoxidizer—new Ferrocarbo briquettes. More complete deoxidation of molten iron is now assured. Higher silicon recovery is now possible. Lower slag iron oxide permits better sulphur removal. Better slag fluidity and slag metal separation results from slag deoxidization. More complete and rapid combustion of coke by the cupola blast effects measurable coke savings. These and many other unique advantages make the new Ferrocarbo briquette the most outstanding contribution to present day cupola deoxidization practices. Why not investigate?

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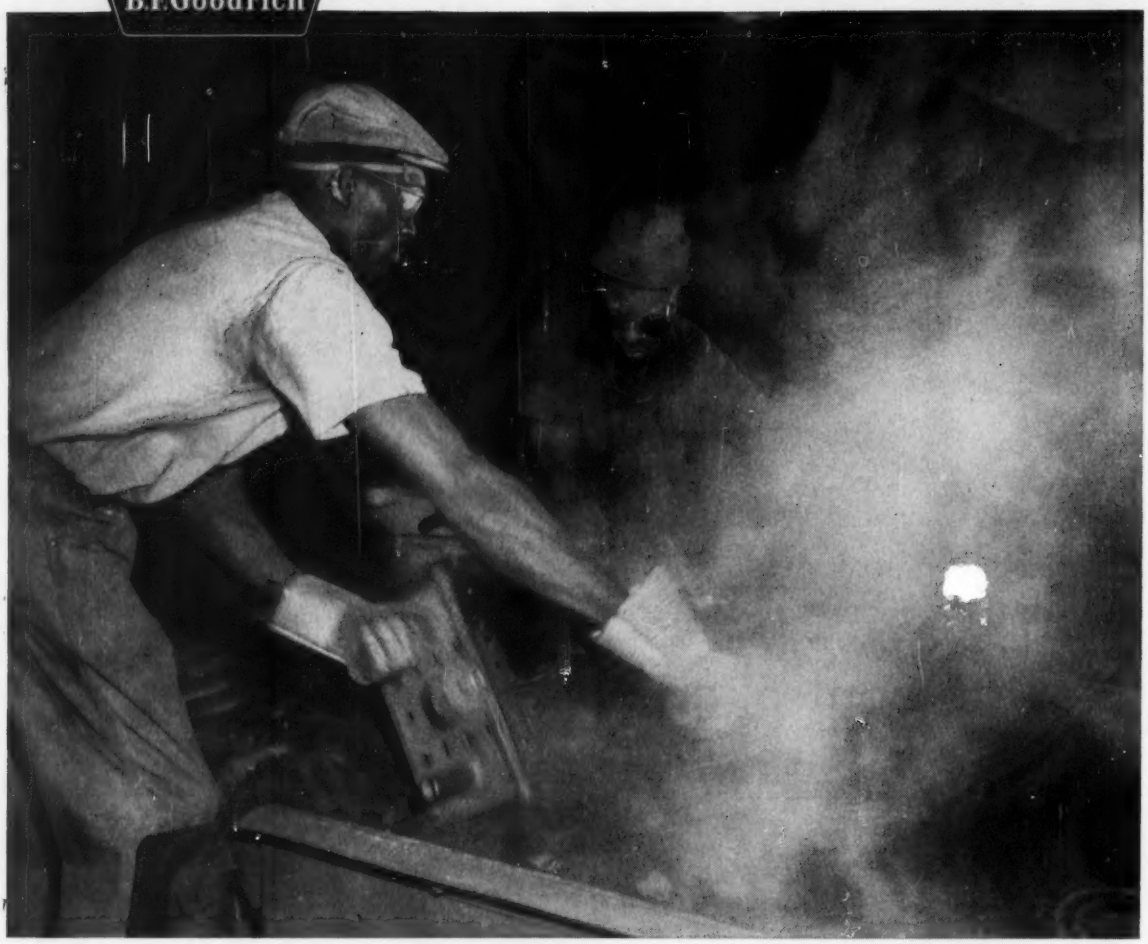

Where belts carrying hot sand now last 50% longer

THOSE men are dumping hot sand from molds into a shake-out grid. The 250-degree sand falls through the grid and down on a conveyor belt nine feet below. But the heat is so intense it even blistered and scorched rubber belts that were supposed to have been specially designed for hot-material service. Belts were only lasting 3 or 4 months.

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B.F.Goodrich *industrial rubber products*

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January 1960
Volume 88—Number 1

FOUNDRY
A PENTON PUBLICATION

This centrifugally cast roll, made of heat-resistant steel, is said to be the largest of its type for continuous strip annealing. It was cast by Electro-Alloys Div., American Brake Shoe Co., at Elyria, Ohio.

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Art Editor: DON S. CADOT

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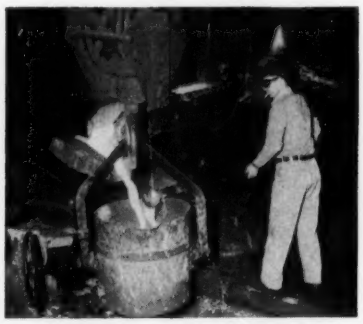
FOUNDRY is edited primarily for management, production, technical, and purchasing personnel in foundries. A copy is sent at no cost to each metal casting plant in the U. S. and Canada employing 20 or more workers and to selected smaller foundries. Additional copies are sent to each foundry to the extent necessary to serve all key foundry personnel on a personal or routed basis. A limited number of copies is supplied at no cost to educational institutions. Subscriptions in the U. S., possessions, and Canada for home-addressed copies and copies not qualified for under the above principles: One year, $10. Single copy, $1. Other countries: One year, $20. Single copy, $2. Published monthly and copyright 1959 by The Penton Publishing Co., Penton Building, Cleveland 13, Ohio. Accepted as controlled circulation publication at Cleveland, Ohio.

THE EDITORS' WORKSHOP

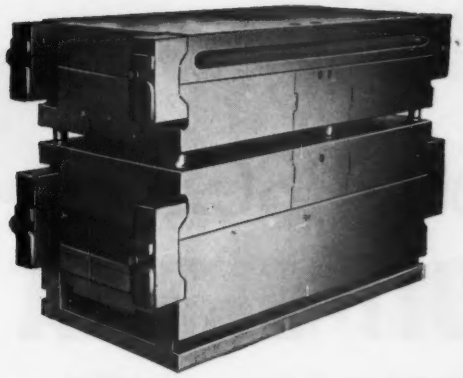
NEW YEAR: You can look forward to seeing a number of interesting and informative articles in our columns early in the new year. Here are some of the topics that will be covered: 1. How to cut casting cleaning costs through mold and core inspection. 2. Melting and casting of aluminum bronze. 3. Use of sodium-silicate binder without gassing. 4. Metallurgy of iron castings. 5. Latest developments in production of shell cores. 6. Mechanical properties of cupola malleable iron. 7. Recent advances in steelmaking practices at Watertown Arsenal.

CUPOLA CONTROL: New developments and special equipment generally arouse the most interest in the various foundry processes. But



it's dangerous to lose sight of the fundamentals that affect everyday operations. A comprehensive review of these fundamentals will be presented shortly in "Practical Tips on Cupola Control." The article was prepared by Sam Carter of American Cast Iron Pipe Co.

URANIUM CASTINGS: Uranium is something more than a fuel source for nuclear reactors; it has unique mechanical properties which make it a valuable structural material for certain applications. In next month's issue, G. D. Chandley and D. G. Fleck of Watertown Arsenal will describe the foundry practice developed there for casting uranium parts of exceptional soundness and uniformly high mechanical properties.



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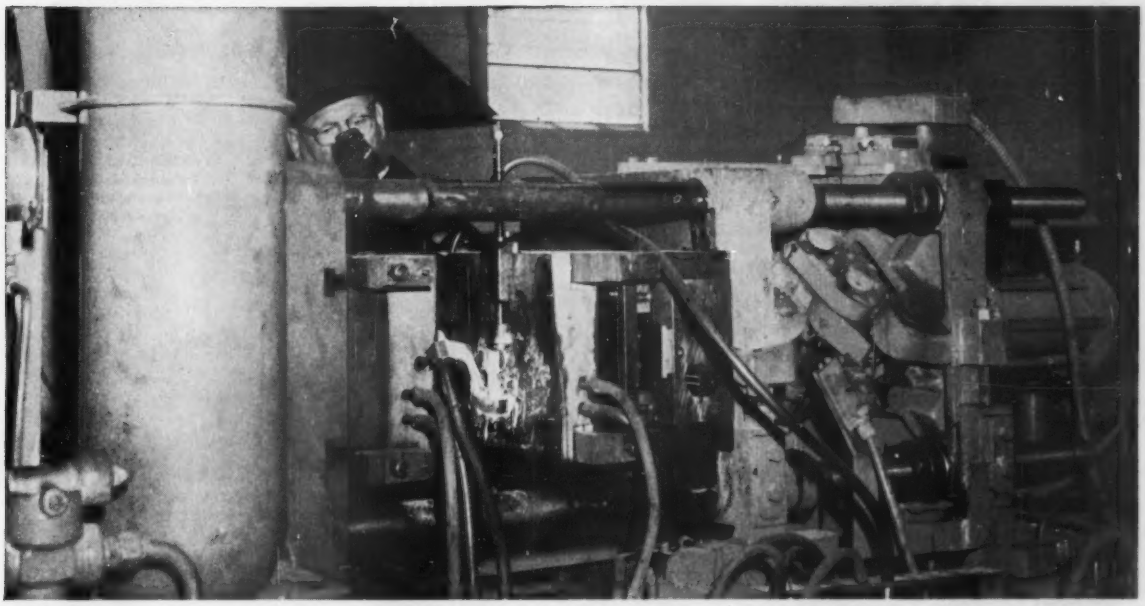

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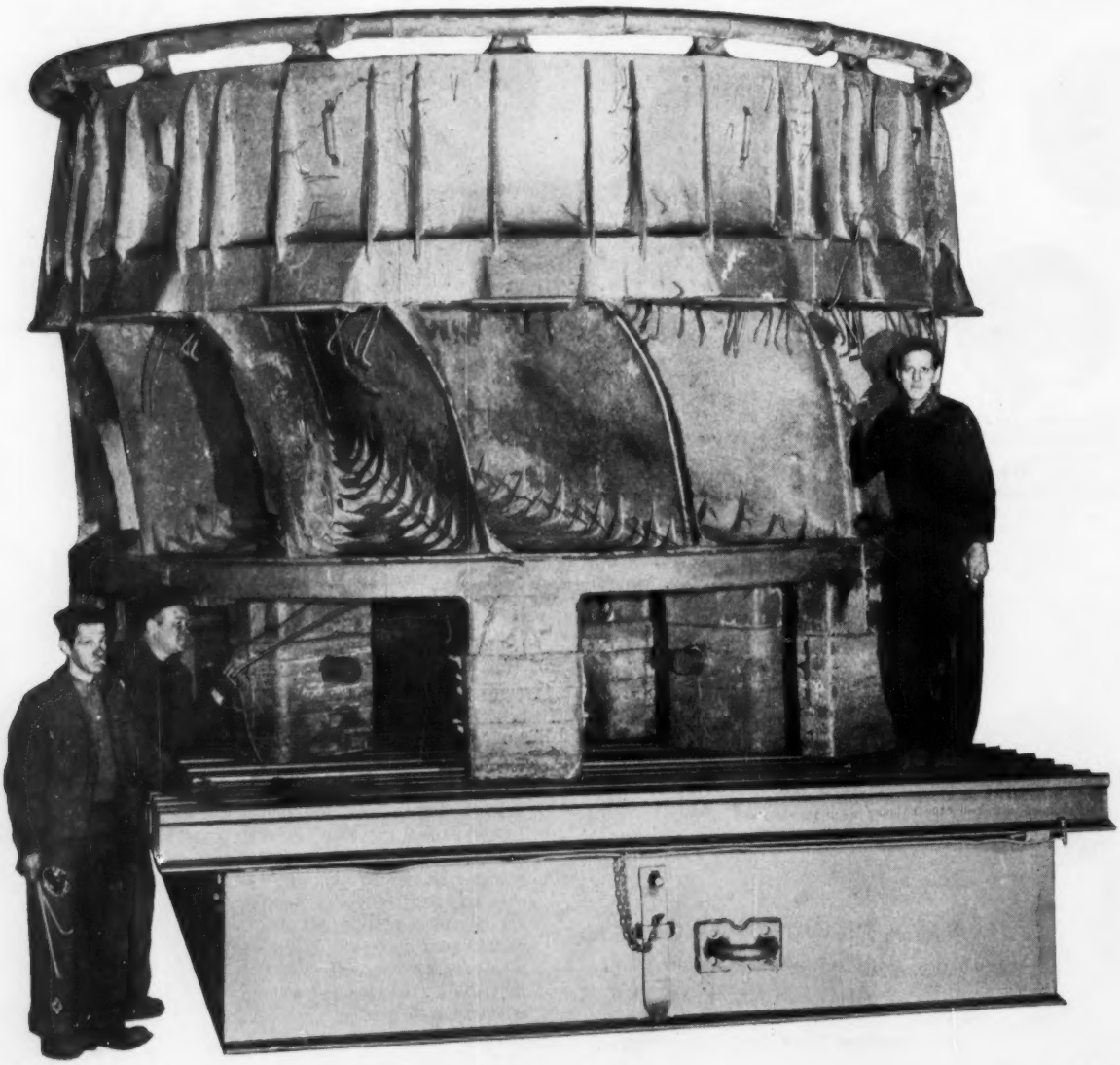

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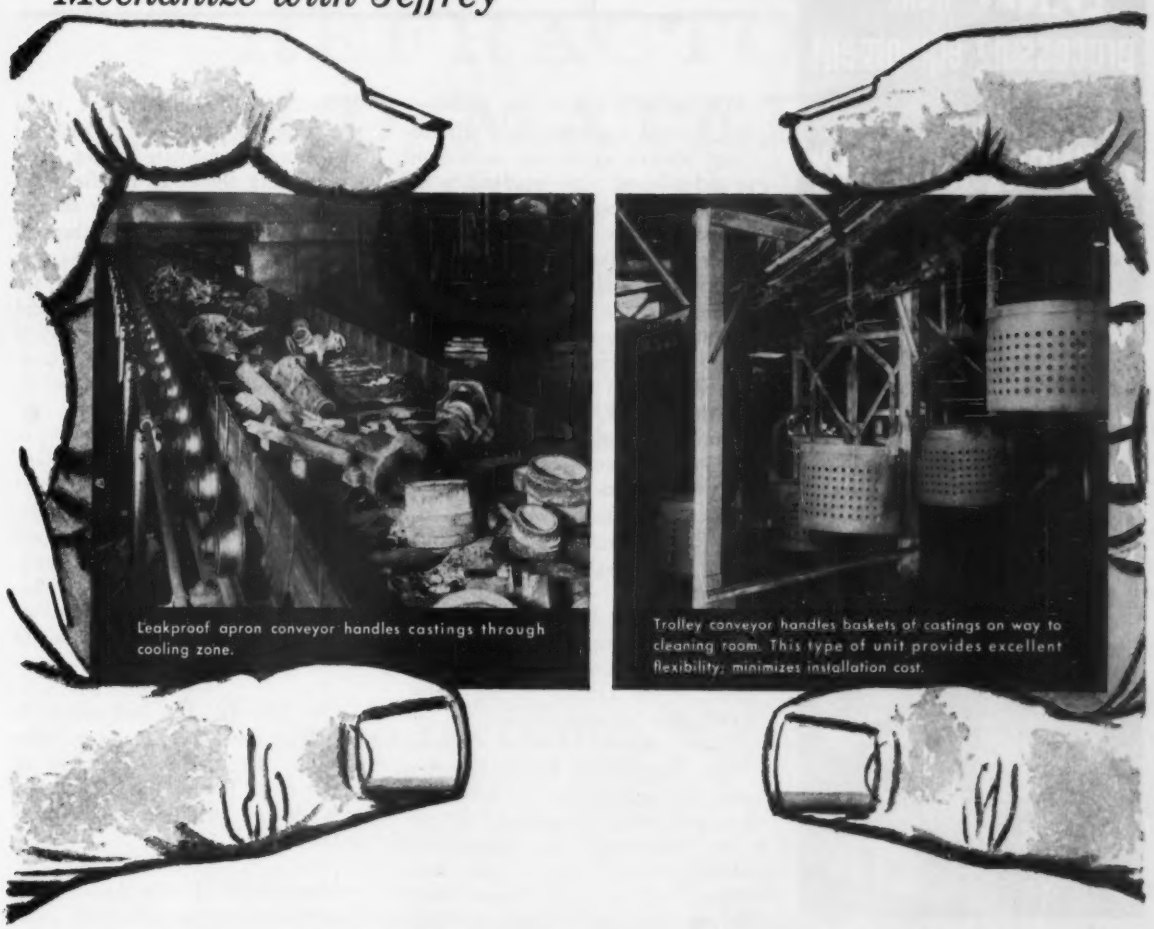
Mechanize with Jeffrey



Leakproof apron conveyor handles castings through cooling zone.

Trolley conveyor handles baskets of castings on way to cleaning room. This type of unit provides excellent flexibility; minimizes installation cost.

MECHANIZED CONVEYING OF CASTINGS CUTS YOUR COSTS

Rugged conveyors—apron, pendant (trolley), or vibrating—move castings efficiently and quickly from shakeout, through cooling zone, to cleaning room. Speeds can be selected for ample cooling time—for chipping and sorting en route.

Starting with basic requirements, Jeffrey Foundry Engineers will help you select just the right conveying equipment for castings... will erect the installation (if desired), and stay on the job until everything is in top-notch working order.

Other foundry operations are important, and Jeffrey builds for them too. Consult our Foundry Engineers for cost-cutting ideas in Sand Handling and Conditioning, Mold Preparation, Castings Handling or for special unit machines. Catalog No. 911 tells all—write, The Jeffrey Manufacturing Company, 907 N. Fourth St., Columbus 16, Ohio.

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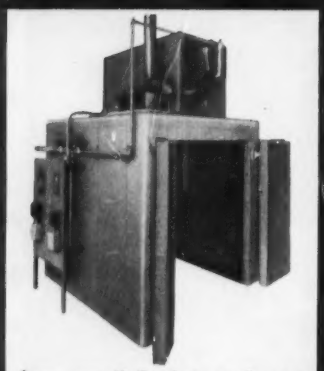

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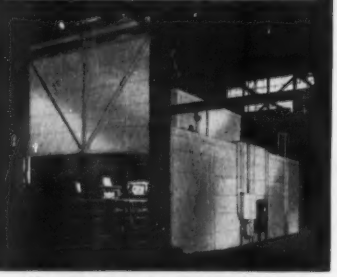

If a need arises to replace or improve your Foundry Ovens, it is only logical to look to LANLY, recognized authorities in the design and construction of heat processing equipment for more than 22 years.

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With the Editors

Of Interest: On several occasions this column has mentioned our Ad-Gage studies which are carried on to provide us with readership information on both editorial and advertising pages of FOUNDRY. Dave Gibbs, our marketing research director, has provided information on the results of a recent study which I would like to pass along.

In the September issue, we presented a series of five articles under the general heading of "Solidification and Heat Treatment." From the many requests for extra copies and the remarks of readers, we knew that these articles were well received, but it remained for the Ad-Gage study to show the interest in figures.

The study of that issue shows that 83 per cent of our readers found material of interest in one or more of the articles in the series. Readership percentages on the individual articles were as follows: "The Equilibrium Phase Diagram and Its Significance in Solidification and Heat Treatment," 49 per cent; "Aluminum and Magnesium Alloys," 33 per cent; "Copper Base Alloys," 32 per cent; "Gray Iron," 40 per cent; and "Steel and Malleable Iron," 39 per cent.

—o—

Splendid Casting: Through the kindness of Ray E. Swift, professor of metallurgical engineering, Douglas W. Cox, foundry technician, and the FEF boys at the University of Kentucky, Lexington, Ky., I am the proud possessor of a beautiful cast bronze nameplate for my desk. The casting shows an excellent degree of workmanship. My sincere thanks to those who carried through the casting job so well.

The nameplate was prepared for my visit to the campus to attend the fall meeting of the University of Kentucky FEF industry committee. The picture reproduced below, taken at that time, shows four FEF scholarship boys (standing left to right) as follows: David B. Routledge, George T. Slaughter, Robert W. Stovall, and Daniel H. Holtzclaw. Seated (left to right) are E. J. Walsh, FEF executive director, and F. A. Osterman, foundry superintendent, International Harvester Co., Louisville, and chairman of the committee.

—o—

Our Thanks: The lead article in this issue has been made possible through the kind co-operation of hundreds of foundrymen. Our sincere thanks to all who supplied data.

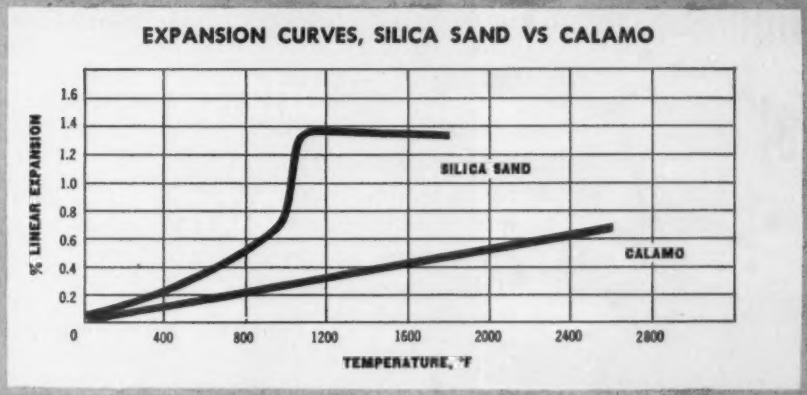
—o—

How Many? Is the foundry industry reaching the saturation point in the matter of meetings? Each fall and spring, when national, regional, sectional, and local meetings abound, and a multiplicity of committee meetings are scheduled, I wonder if the time is not approaching when efforts toward consolida-

Harbison-Walker

REFRACTORY MOLD MATERIALS

for metal casting



Calamo for Investment Molds

CALAMO, one of the extensively used Harbison-Walker products for molding is an alumina-silica refractory of optimum sizings for various molding mixtures. Its fusion point is 100°F. higher than that of normal silica sand mixes.

The chart above shows the exceedingly desirable expansion curve of CALAMO as compared with that of silica sand.

CALAMO, used as the major constituent of precision casting investment mixes, improves dimensional constancy of molds, makes them stronger and more resistant to erosion by metal flow.

Investment costs are measurably reduced because an appreciably lesser amount of bonding agent is needed. This is attributable to the very desirable particle sizing and the equiaxed, dense grains of CALAMO.

CALAMO, used alone or as the major part of conventional dry sand molding mixes in rammed or in slinger-placed sand molds, provides not only the very desirable low thermal expansion characteristics particularly suited for precision casting but also provides the required refractoriness for metals and alloys melted at unusually high temperatures.

H-W Flintgrain for Ceramic Shell Molds

H-W FLINTGRAIN is an alumina-silica refractory, similar in composition to CALAMO, having the same very desirable low thermal expansion characteristics, but greater angularity of grain shape.

The angular grain shape and optimum size distribution make H-W FLINTGRAIN ideal for securing maximum compactness in the mold. It is used with special benefit for making ceramic shell molds and for similar applications in which dense, compact mold sections of greatest volume stability at all temperatures, are of paramount importance.

Illustration of angulate shape of H-W Flintgrain enlarged x3

Write us for information regarding these and other Harbison-Walker products — mold wash materials — ceramic molding media — mold sand bonding clays.

HARBISON-WALKER REFRACTORIES COMPANY

AND SUBSIDIARIES — GENERAL OFFICES: PITTSBURGH 22, PENNSYLVANIA

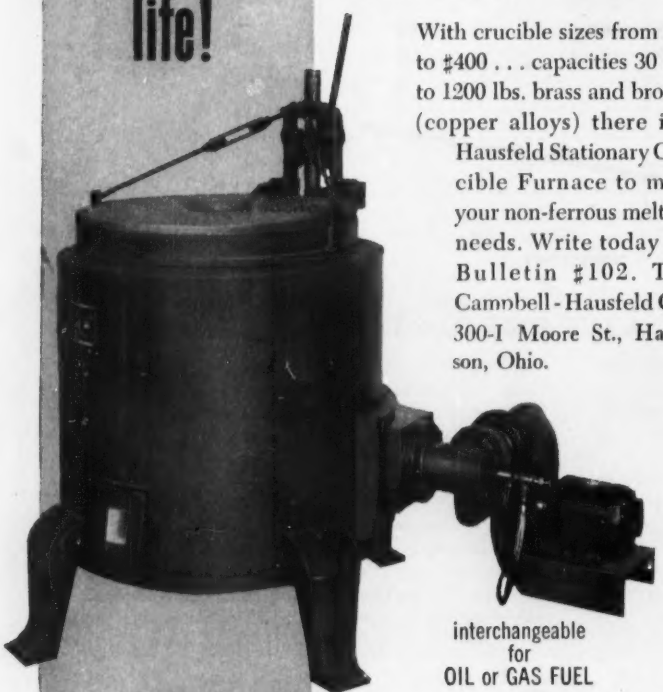
World's Most Complete Refractories Service

Engineered for longer crucible life!

■ In the Oil Fuel models, as shown, the special higher-pressure mechanical atomizing oil spray—a Hausfeld exclusive – produces a clear, hot flame with minimum cutting action . . . *increases* crucible and lining life.

■ Well insulated lining assures uniform heat dispersal – cuts heat loss and assures many years of fast, efficient melting of brass and bronze.

With crucible sizes from #10 to #400 . . . capacities 30 lbs. to 1200 lbs. brass and bronze (copper alloys) there is a Hausfeld Stationary Crucible Furnace to meet your non-ferrous melting needs. Write today for Bulletin #102. The Campbell-Hausfeld Co., 300-I Moore St., Harrison, Ohio.



interchangeable for OIL or GAS FUEL

Hausfeld STATIONARY CRUCIBLE FURNACES

CAMPBELL-HAUSFELD
METAL MELTING FURNACES

tion and simplification of that activity are not in order. The thought may be engendered by comments of foundrymen I meet. They seem to be finding difficulty in attending all of the meetings in their fields. Perhaps this justifies some consideration by future planners.

—o—

Twenty Per Cent: In the November issue this department commented on the travel schedule necessary for editors to cover these many meetings. Since the reports have been prepared and have appeared in November and December, or will be presented in this issue, I checked on the amount of space required. To my surprise, I found that a total of 37 pages in the November and December issues were needed to present meeting reports, 18.5 pages for national meetings and 18.5 pages for regional meetings.

Although the January issue has not been sent to the printer as this is written, it looks like 10 pages will be used for meeting reports. In three issues, FOUNDRY has used 20 per cent of its editorial space to report on meetings. If that seems like a lot of copy, think of the time and effort which speakers at these many meetings devoted to the preparation and presentation of their talks.

—o—

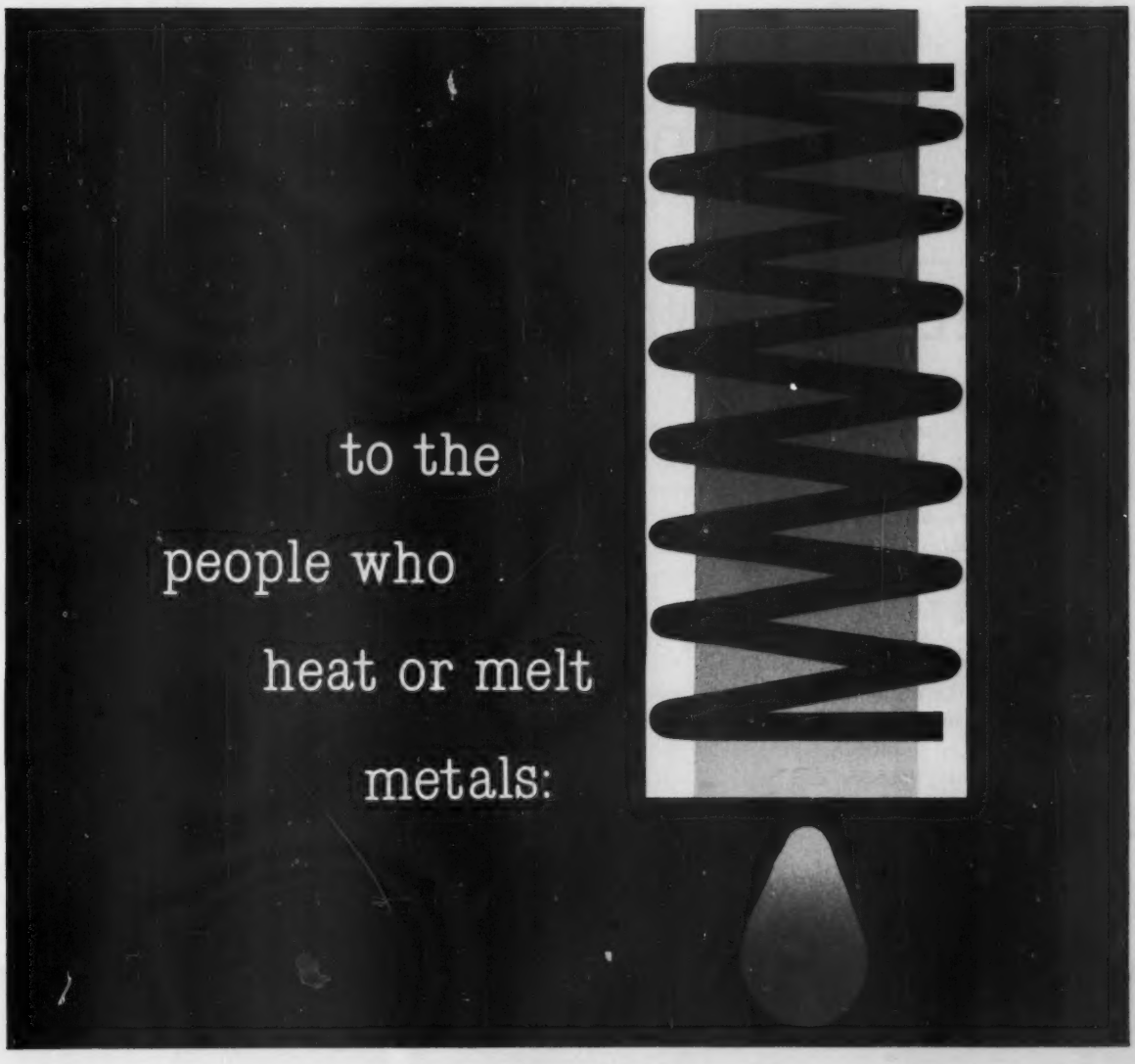
Awards: A year ago the National Foundry Association at its annual meeting conferred a special "Herman" award to the members of the cast of a special skit, "The Eneff Ay Foundry Co.," presented at the 1957 meeting.

The award was so well received that it was continued this year. Awards were presented at the recent New York annual meeting to Allen M. Slichter, president, Pelton Steel Castings Co., Milwaukee, for his graphic presentation of "An Effective Communications Program," and to James J. Ewens, vice president, Grede Foundries Inc., Milwaukee, for his interesting report on the communication program of his company.

—o—

Happy New Year: Another year is starting, and it looks like a good one. From the FOUNDRY gang to all our readers, best wishes for a year of peace, health, happiness, and good business.

F.G.S.



Induction Heating is used to heat all metals, including the new high-temperature alloys and exotic metals, to temperatures ranging from a few hundred degrees to several thousand degrees.

Historically, Induction Heating manufacturers have specialized and have provided a service to specific application areas. This specialization has confined the many advantages of Induction to a few specific fields. Actually, most metalworking operations can be improved by the use of Induction equipment.

By joining the pioneer companies (Ajax Electrothermic, Ajax Engineering and Magnethermic) into one company, we offer a service unavailable before. A single manufacturer of Induction equipment with the background, facilities and product line permits an unbiased evaluation of your heating or melting application.

More A M equipment in use than any other make.

John A. Lyon
President

Ajax Magnethermic CORPORATION
Induction Heating is our ONLY Business

GENERAL OFFICES: Youngstown 1, Ohio
AJAX ELECTROTHERMIC DIVISION
Trenton 5, New Jersey
MAGNETHERMIC DIVISION
Youngstown 1, Ohio
AJAX ENGINEERING DIVISION
Trenton 7, New Jersey

Circle 563 on Page 53

HOW REPUBLIC PIG IRON SERVICE IN DEPTH HELPS FOUNDRYMEN EVERYWHERE

Pig iron *service in depth* is an exclusive Republic concept. It is designed to help you solve foundry production and metallurgical problems—designed to help you produce better castings most efficiently, economically, and profitably.

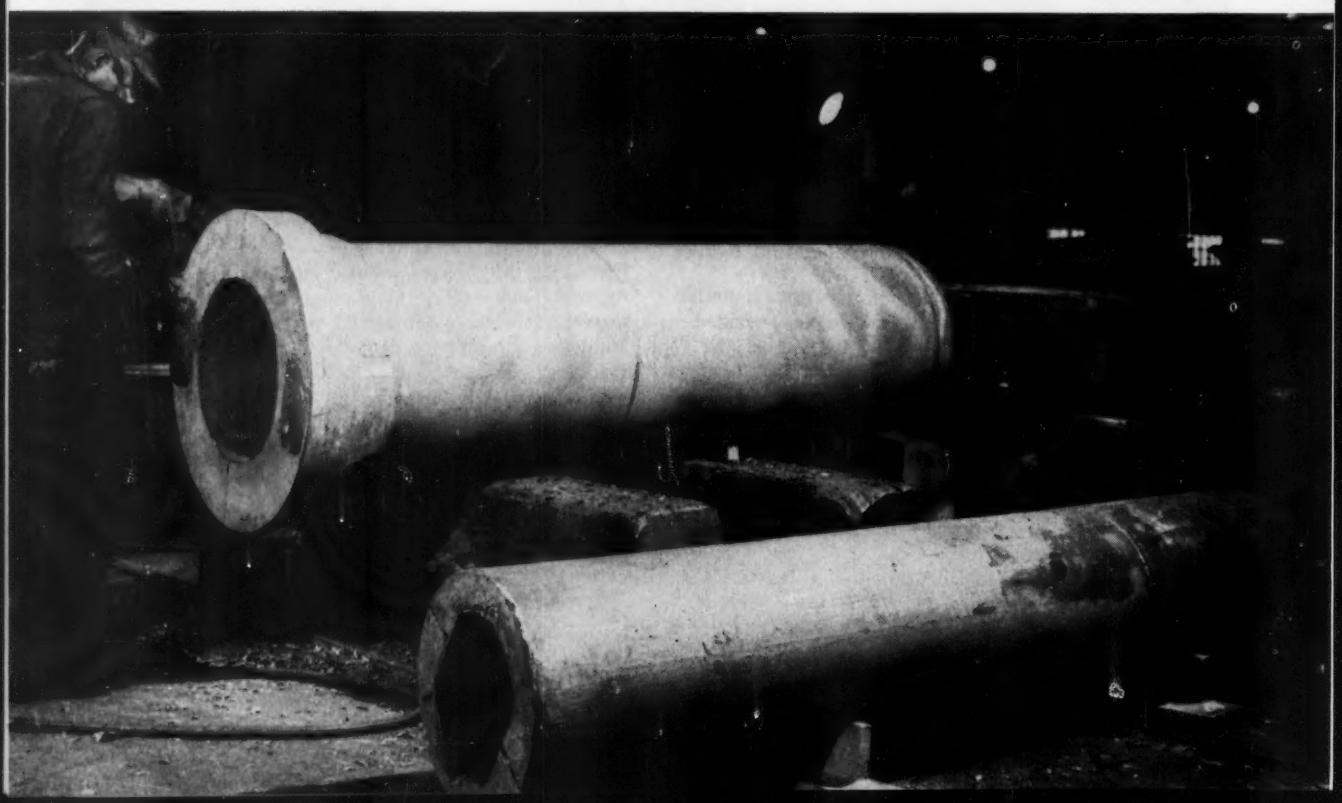
Here is how *service in depth* helps foundrymen everywhere.

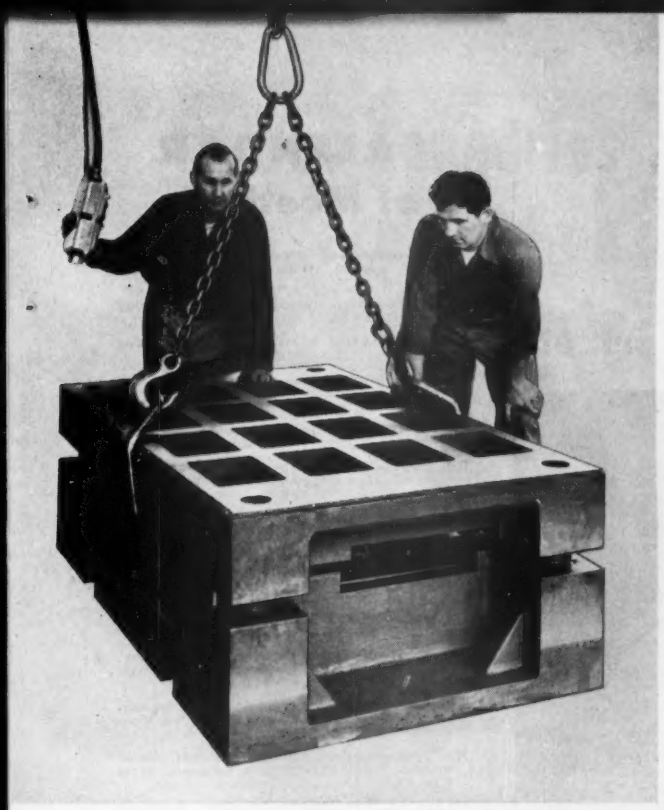
First, Republic is the only producer of both Northern and Southern Irons. This means you can select the proper grade from the most complete line of merchant pig iron available in the industry. Northern grades include Chateaugay, Malleable, Bessemer, Foundry, and Basic. Southern furnaces produce Foundry and Basic.

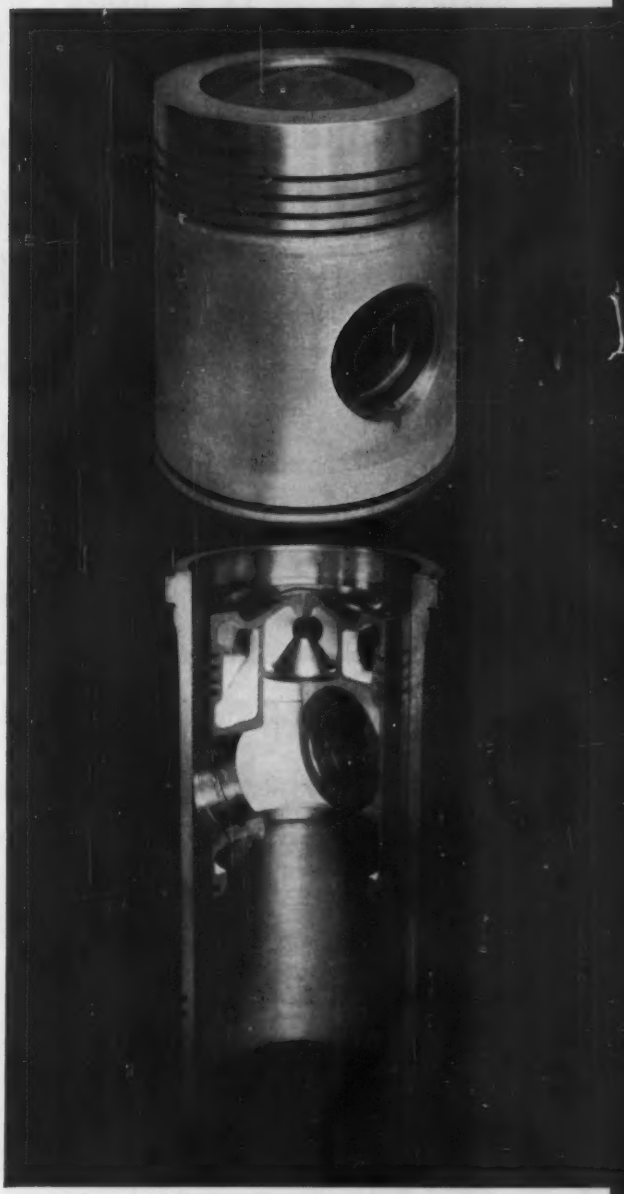
Then, Republic provides expert metallurgical service to assist you in selection, application, and processing. Republic Pig Iron Metallurgists are frequent and welcome visitors in hundreds of foundries. They have at their fingertips information on the latest processes and techniques available for improving castings, and for expanding their use and sale. Their suggestions often result in improved operations, increased production efficiency, and in recapturing business lost to other methods of fabrication.

Service in depth is available now. Clip and mail the coupon for obligation-free metallurgical service, or for more information on Republic Pig Irons.

Here are three examples of pig iron *service in depth.*







1. UNIFORM CHEMISTRY HELPS PRODUCE HIGHEST QUALITY DIE SETS. The Producto Machine Company, Bridgeport, Connecticut, casts die set parts using only raw materials with a definite known analysis, including Republic Pig Irons. The year-in, year-out uniform chemistry of these fine irons helps Producto produce high quality, laboratory-controlled castings. The company has found that there is no better, no more economical means for insuring strong, flaw-free, easy-to-machine castings.

2. CHATEAUGAY AGAIN PROVED IDEAL BASE METAL FOR DUCTILE IRON. Problem: Design a diesel engine piston with high mechanical strength, minimum weight, maximum wear- and heat-resistance, low ultimate cost. Using Chateaugay Pig Iron as the base metal, Hunt-Spiller Manufacturing Corporation, Boston, Massachusetts, successfully met all of these requirements in developing ductile iron diesel pistons as a replacement for aluminum. High total carbon and unusually low phosphorus, silicon, and manganese suit Chateaugay perfectly to ductile iron use. Inherently excellent physical properties are maintained in the ductile form assuring strong, flaw-free casting accurate to patterns and shapes.

3. METALLURGICAL SERVICE BENEFITS FOUNDRY'S CUSTOMER. On the advice of a Republic Pig Iron Metallurgist, Atlantic Foundry Company, Akron, Ohio, switched to Chateaugay Pig Iron for ram and cylinder castings used in hydraulic presses. The result: stronger castings, better machinability, higher wear-resistance, and a 21% saving to the customer. The value of Republic metallurgical service is pointed out in this statement by Atlantic's Vice President of Iron Foundry Operations. "When we have a foundry problem and put in a call for help, your metallurgical engineers are Johnny-on-the-spot, talking a language we can understand. Then it's not long before the problem is solved."

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

Circle 564 on Page 53

REPUBLIC STEEL CORPORATION
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1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

☐ Have a Pig Iron Metallurgist call.

Send more information on:
☐ Republic Pig Irons

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WHY PAY MORE

when you can buy the best binder at the lowest price!

INSIST ON STEINEX

the original CO_2 Binder available only from Carver

BEST QUALITY Steinex gives you absolutely the best shakeout —BY FAR!

BEST PRICE Steinex is 30% lower in cost than any other binder on the market!

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JOIN THE HUNDREDS OF FOUNDRIES THAT INSIST ON THE BEST

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Muscatine, Iowa

RUSH **information and prices on Steinex binders.**

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FOUNDRY _____

CITY _____ STATE _____

CALENDAR of Meetings

Jan. 15—Malleable Founders Society, semi-annual meeting, Hotel Sheraton-Cleveland, Cleveland.

Jan. 25-28—Plant Maintenance & Engineering Show, Convention Hall, Philadelphia.

Jan. 27—Plumbing Brass Institute, Hollywood Beach Hotel, Hollywood, Fla.

Feb. 4-5—Alloy Casting Institute, midwinter meeting, Hotel Key Biscayne, Key Biscayne, Fla.

Feb. 11-12—Wisconsin Regional Foundry Conference, Schroeder Hotel, Milwaukee.

Feb. 17-18—Malleable Founders' Society, Technical and Operating Conference, Wade Park Manor, Cleveland.

Feb. 18-19—Southeastern Regional Foundry Conference, Thomas Jefferson Hotel, Birmingham.

Mar. 7-8—Steel Founders' Society of America, annual meeting, Drake Hotel, Chicago.

Mar. 16-17—Foundry Educational Foundation, annual college-industry conference, Hotel Statler-Hilton, Cleveland.

Apr. 13-14—Malleable Founders' Society, Market Development Conference, Edgewater Beach Hotel, Chicago.

May 9-13—American Foundrymen's Society, 1960 Castings Congress and Exposition, Convention Hall, Philadelphia.

May 9-13—American Society for Metals, Southwestern Metal Exposition & Congress, State Fair Park, Automobile Building, Dallas.

May 11-13—Los Angeles Chapter, American Material Handling Society, Western Regional Materials Handling Show and Packaging Cavalcade, Great Western Exhibit Center, Los Angeles.

May 23-26—Design Engineering Show, Coliseum, New York.

June 2-3—New York University, vacuum metallurgy conference, University Heights (Bronx) Campus, New York.

June 6-7—Malleable Founders' Society, annual meeting, Elbow Beach Surf Club, Hamilton, Bermuda.

June 6-8—Material Handling Institute Inc., New England Show, Commonwealth Armory, Boston.

June 19-21—Alloy Casting Institute, annual meeting, Homestead, Hot Springs, Va.

July 4-6—European Investment Casters Conference, Liege, Belgium.

Sept. 6-16—The Machine Tool Exposition—1960, International Amphitheatre, Chicago.

Sept. 6-16 — Production Engineering Show, Navy Pier, Chicago.

Sept. 19-20—Steel Founders' Society, fall meeting, Homestead, Hot Springs, Va.

Sept. 19-24—International Foundry Congress, Zurich, Switzerland

Sept. 22-23—National Foundry Association, annual meeting, Edgewater Beach Hotel, Chicago.

Oct. 12—Cast Bronze Bearing Institute, annual meeting, Grove Park Inn, Asheville, N. C.

Oct. 13-14—Gray Iron Founders' Society, annual meeting, Netherland Hilton Hotel, Cincinnati.

Oct. 13-15—Non-Ferrous Founders' Society, annual meeting, Grove Park Inn, Asheville, N. C.

Oct. 17-21—American Society for Metals, National Metal Exposition & Congress, Trade and Convention Center, Philadelphia.

Oct. 20-22—Foundry Equipment Manufacturers Association, annual meeting, Greenbrier Hotel, White Sulphur Springs, W. Va.

Oct. 21-23—Society for Experimental Stress Analysis, annual meeting, Pick Fort Shelby Hotel, Detroit.

Oct. 22-25—Conveyor Equipment Manufacturers Association, annual meeting, Greenbrier, White Sulphur Springs, W. Va.

Nov. 8-10—Material Handling Institute Inc., Central States Show, Kentucky Fair and Exposition Center, Louisville.

Nov. 14-16—Steel Founders' Society, Technical and Operating Conference, Pick Carter Hotel, Cleveland.

Why Foundries are Sold on

CarVer RAPID MULLER

1 "We are using natural bonded sand in our plant and find the Carver Muller has cut down on bonding material better than 50%. We like the Muller very much."

— E. W. Maxfield
West Coast Alloys Co.
Troutdale, Oregon

2 "The Carver does a good job for what it was designed. A low priced mixer. Small floor space and does a good job of mixing with CO_2 Sand."

— Neilan Williams, Vice President
Industrial Castings Division
James H. Matthews Co.
Pittsburgh, Pennsylvania

CHECK . . . COMPARE AND YOU'LL CHOOSE CARVER!

- **The fastest! A batch every 75 seconds!***
- **Only one moving part . . . no maintenance worries!**
- **Absolutely no lumps or wet spots!**
- **Easiest to clean! Just reach inside!**
- **3 times lower initial investment than with most mullers!**
- **Works equally well with any kind of binder!**

*Applies to CO_2 Sand. Oil sand may take up to three minutes.

Only CarVer Has Everything For the CO_2 Process!

CARVER V & S Core Shooters

CARVER Automatic Gassing Apparatus

KRAUSS Taper Slot Core Vents

STEINEX available only from CARVER

MAIL COUPON TODAY

CARVER FOUNDRY PRODUCTS CO.
Muscatine, Iowa

I want to compare! Tell me more about Carver Rapid Muller.

NAME _____ TITLE _____

FOUNDRY _____

CITY _____ STATE _____

Circle 566 on Page 53

APPROVED and PROVED
NATION WIDE!

"SW" CUPOLA COLLECTOR PICKED FOR PERFORMANCE AND MONEY-SAVING VALUE

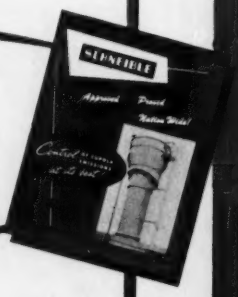
More and more foundries, small and large, are realizing the benefits from the performance of Schneible "SW" Cupola Collectors for control of cupola fly-ash and smoke.

Since such improvements are major expenditures it is important that purchase of *Cupola Collector* equipment be based on *proved performance* to assure maximum dollar value with minimum maintenance, and long usefulness.

Be sure to investigate the many benefits that are yours with Schneible "SW" Cupola Collectors, before you decide on any *similar* equipment. Only Schneible patented features gives you all the money-saving advantages.

YOUR BULLETIN ON REQUEST

For the complete story on the "SW" Cupola Collector write today for your copy of Bulletin No. 554.



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AIR POLLUTION
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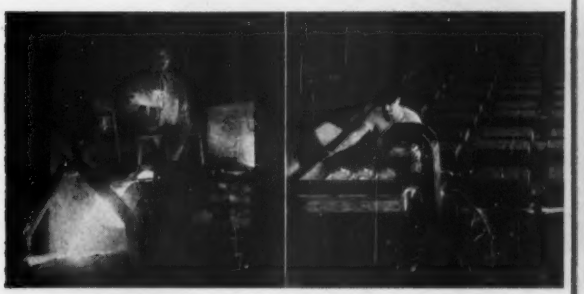
PRODUCTS:

Multi-Wash Collectors • Uni-Flo Standard Hoods • Uni-Flo Compensating Hoods • Uni-Flo Fractionating Hoods • Water Curtain Cupola Collectors • Ductwork • Velocitrap • Multi-Dyne Separators • Entrainment Separators • Settling and Dewatering Tanks • Skimmer Type Concentrating Tanks • Pressure Vessels and Storage Tanks

Refer to Sweet's File No $\frac{1e}{5c}$

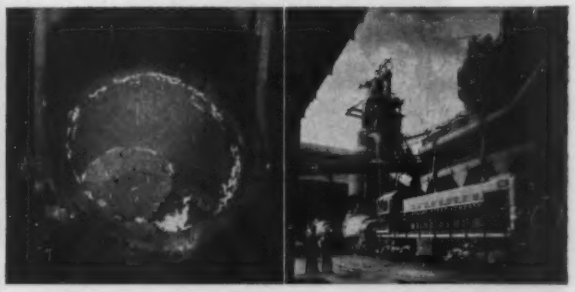
FIRE CLAY ... specifically Goose Lake Fire Clay serves the metal producing industry in many important ways

IN FOUNDRIES...



Fire Clay in pulverized or flour form provides an ideal bond for molding sands. As a special service, bulletins entitled "How to Improve Molding Sands" are periodically published and distributed free to the foundry industry. Helps foundrymen keep up to date on molding sand additives. Fire Clay Castables can be "gunned-on" to line cupolas . . . cuts lining time 75%, reduces refractory costs 43%. Fire Clay Brick provides an excellent lining for ladles. Goose Lake Fire Clay is widely used wherever intermediate heat-duty requirements must be met.

IN STEEL PLANTS...



Goose Lake Fire Clay provides an excellent mortar mix for general bricklaying purposes and for laying-up ladle brick (also made of fire clay) in iron and steel ladles. Generally used to form ladle wells, for plugging tap holes and, when mixed with grog, to line blast furnace troughs. Ideal for lining the bottoms of Bessemer Converters . . . for general mudding and daubing operations and as a fill material between the lining and shell of blast furnaces.

Readily accessible deposits of high quality clays, continuous research and quality controlled manufacturing procedures all add up to the fact that "Illinois Clay" offers a prime source for fire clay products. Take advantage of our long experience in this field . . . write or phone for additional information.

ILLINOIS CLAY PRODUCTS CO.

Main Office—Barber Building, Joliet, Illinois
Sales Office—208 South LaSalle Street, Chicago 4, Illinois

MANUFACTURERS OF: GOOSE LAKE Ladle Brick, Ground Fire Clay, Fire Clay Flour; GRUNDITE Bond Clay; FIROX; THERM-O-FLAKE Insulation Coating, Brick, L.B. Block, Concrete; CHEM-BRIX, Silica, Carbon

Circle 568 on Page 53

HINES all-purpose SLIP FLASKS

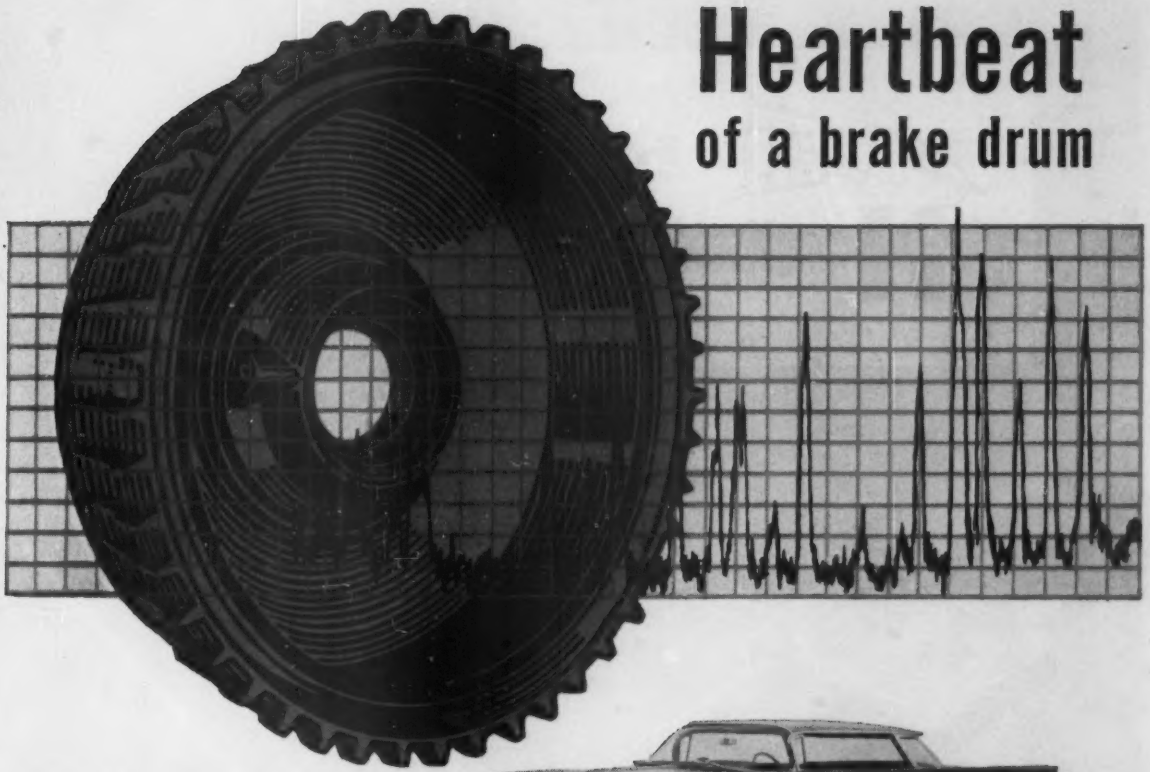
- Ideal for match plate work and light cope and drag patterns on squeeze machines with pistons up to 14".
- These high-quality, lightweight flasks have no equal for efficiency, speed and low upkeep.
- Equipped with self-locking sand strips, operated by two throw-out levers.
- Lengths and widths, from 10" to 24". Depths from 7" to 12". Single or double, round, hex or "V" pins, bushings or guides — or pads for your own pins.

WRITE FOR CATALOG FOLDER NO. 210

THE HINES FLASK CO.
3431 WEST 140th STREET • CLEVELAND 11, OHIO

HINES FLASKS

Heartbeat
of a brake drum



Count the other ways Buick uses x-ray emission spectrometry

- Evaluation of heat-treatment processes
- Identification of engine deposits
- Analysis of purchased lubricants "in less time than it would take a chemist to set up his glassware"
- Routine analysis of structural and tool steels, bearing metals, copper base materials and others

Buick uses G-E x-ray emission spectrometry to promote uniform brake drum metal quality.

Product development . . . that highly stressed interval between an engineering conception and a smoothly functioning production line . . . is the time of great imbalance in the ratio of Questions to Answers. Buick has found the General Electric XRD-5S x-ray emission spectrometer a great help in balancing this ratio. Analyzing their foundry slag for FeO content, they can keep close tabs on cupola combustion efficiency. Spectrometry shines again in furnishing fast, accurate analyses of Mn, Ni, Cr, and Mo samples from the melt. That's not all . . . look at the other applications at left.

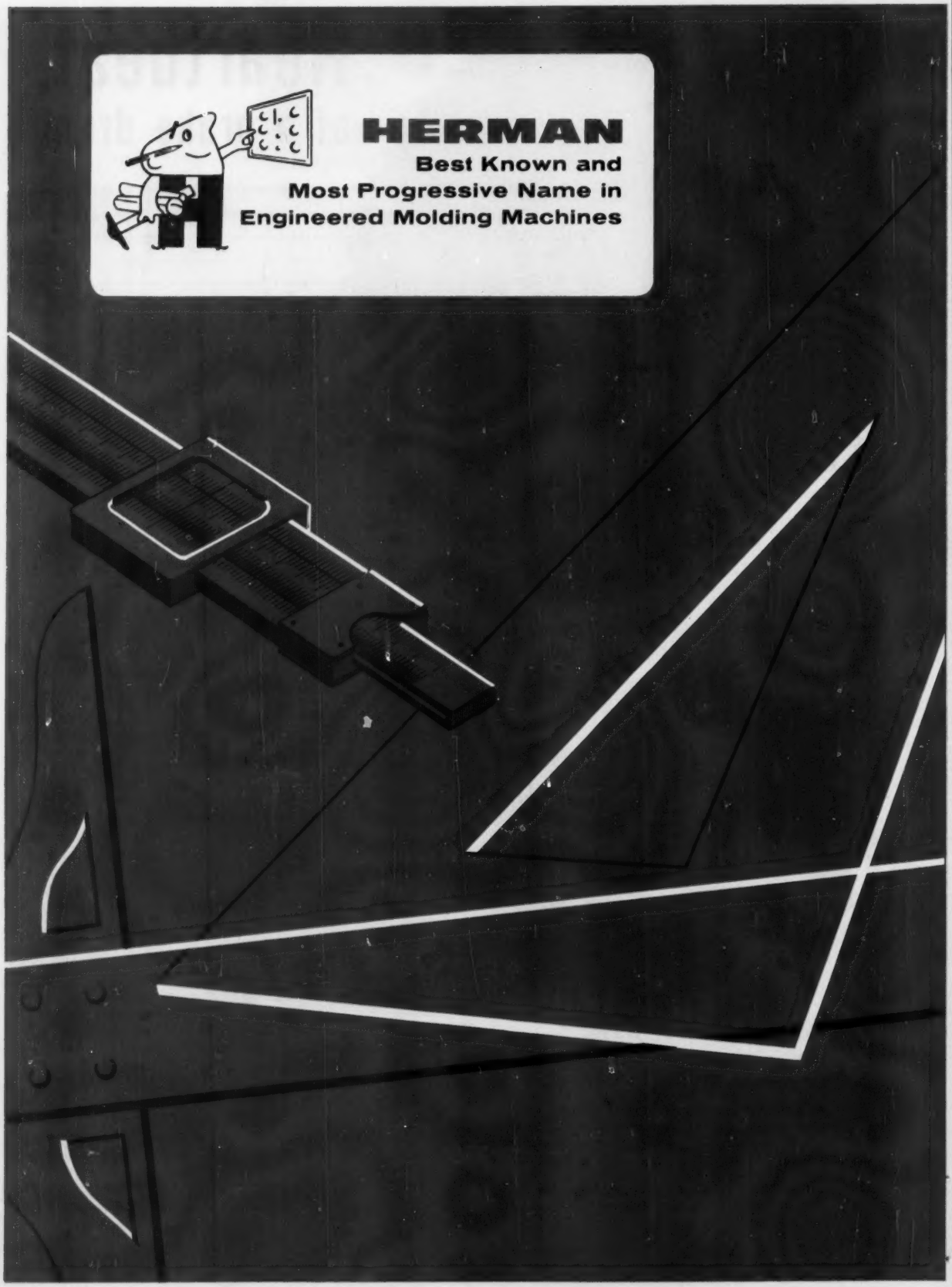
Producing recordings on film or charts (like that shown above), General Electric XRD-5 units accept large or small samples with equal readiness . . . perform both qualitative and quantitative analysis. And fast! One case — a typical one — saw a two week wet-chemical analysis slashed to one hour.

Where can x-ray spectrometry . . . or its versatile companion, diffraction . . . fit in your production plans? Find out from your GE x-ray representative. Or write General Electric X-Ray Department, Milwaukee 1, Wisconsin for Pub. YY-14.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Circle 570 on Page 53


HERMAN
Best Known and
Most Progressive Name in
Engineered Molding Machines

STATIONMASTER . . . MOLDMASTER . . . CHARGING CONVEYOR ROLLOVER AND DRAW . . . VERTICAL CENTRIFUGAL . . .

ISLAND-PAC . . . these and other trade names are becoming synonymous with the name Herman. They are indicative of a philosophy that has been active in our organization for a number of years.

A philosophy that started as a trend in our thinking, and has blossomed into a full-blown and integral part of our day-to-day work.

We are interested in just one thing, in the last analysis:

The development of modern, progressive types of molding machines which will contribute to better foundry practice everywhere.

We believe the machines mentioned above are doing just that.

Performance proves it.

Production records demonstrate it.

Fast amortization nails it down with a proper relationship to foundry profit.

Why not call in a Herman sales engineer, to see which one of our 15 different types of molding machines fits into *your* foundry?

HERMAN PNEUMATIC MACHINE CO.
UNION BANK BUILDING, PITTSBURGH 22, PA.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

A Timely Message for Foundry Managements

CHECK OPERATING EFFICIENCY WITH A KNIGHT ENGINEERED AUDIT

Successful Knight Engineering experience with hundreds of foundry problems throughout the world is available to you for an objective review of your utilization of existing manpower and facilities. This objective audit has assisted many foundries to increase productivity without additional capital investment, and to establish a step-by-step facilities program which is self-amortizing.

KNIGHT SERVICES INCLUDE:

Foundry Engineering • Architectural Engineering • Construction Management
Organization Management • Industrial Engineering • Wage Incentives
Cost Control • Standard Costs • Flexible Budgeting • Production Control
Modernization • Mechanization • Methods • Materials Handling
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Lester B. Knight & Associates, G.M.B.H., Berliner Allee 47, Düsseldorf, Germany

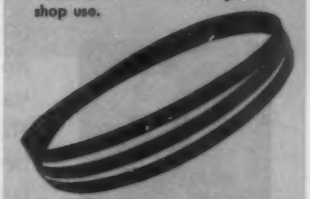
Circle 572 on Page 53

Removing risers from these big, unwieldy aluminum castings is a fast, low-cost job with the DoALL Zephyr band machine. Cuts are made in seconds safely and with fine finish here at the Ross Pattern & Foundry Development Co. of Sidney, Ohio.

Assisting on this job was Meredith L. Cline of DoALL Dayton Co. He is one of over 200 DoALL Sawing Specialists ready to help foundries achieve higher production at lower costs. Their expert help is free.

The ZEPHYR is a rugged, high-tool velocity sawing machine for production cutting of nonferrous materials and friction sawing.

The UTILITY MACHINE is a low-cost, versatile band saw for general shop use.



DoALL SAW Bands—to saw every metal and material. Over 300 width-pitch-set combinations; 18 styles in both carbon and high-speed steel . . . also file bands, grinding bands and polishing bands. The DoALL friction saw blade is the finest the industry has ever produced!

How DoALL Band Saws Can Help You Cut Foundry Costs

Whether your castings are large or small, simple or complex, ferrous or nonferrous, DoALL has the equipment and the experience to save you both time and money.

For example, Ross Pattern & Foundry Development Co. uses a DoALL Zephyr band machine with a ⅝", 3-pitch blade to cut 2" x 4" risers from these 20" x 48" castings of 108 aluminum. And note the accessibility band sawing offers.

Foundries all over America are using DoALL band machines to cut off gates, risers and flash. These versatile machines also handle many other money-making jobs: slitting, slotting, splitting, notching, beveling, etc. Results: lower production costs, faster deliveries.

DoALL band machines and blades are designed to work together as a high-production team. And they're distributed by a single source that guarantees service and results.

Your nearby DoALL Sawing Specialist understands foundry problems. His experience and the services of the DoALL Research Laboratory are yours for the asking—free. Call your DoALL store today.

B-59

THIS IS A TYPICAL DoALL STORE

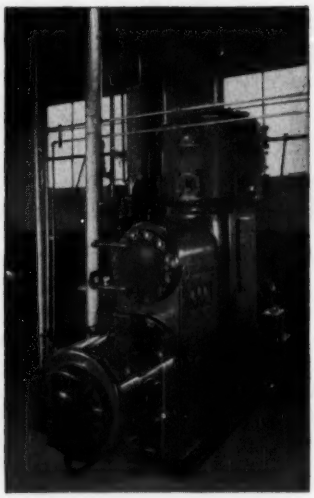
The DoALL Company, Des Plaines, Illinois

60,000 HOURS . . . WITH NO BEARING WEAR

in this IR compressor

Sound unbelievable? Here's how it happened.

This 125-hp Ingersoll-Rand XLE compressor was installed in 1950 at the Standard Products Company in Cleveland. By the summer of 1958 the unit had totalled approximately 60,000 hours of operation, averaging 20 hours a day, six days per week. It was shut down for complete annual inspection as part of the plant preventive maintenance program.



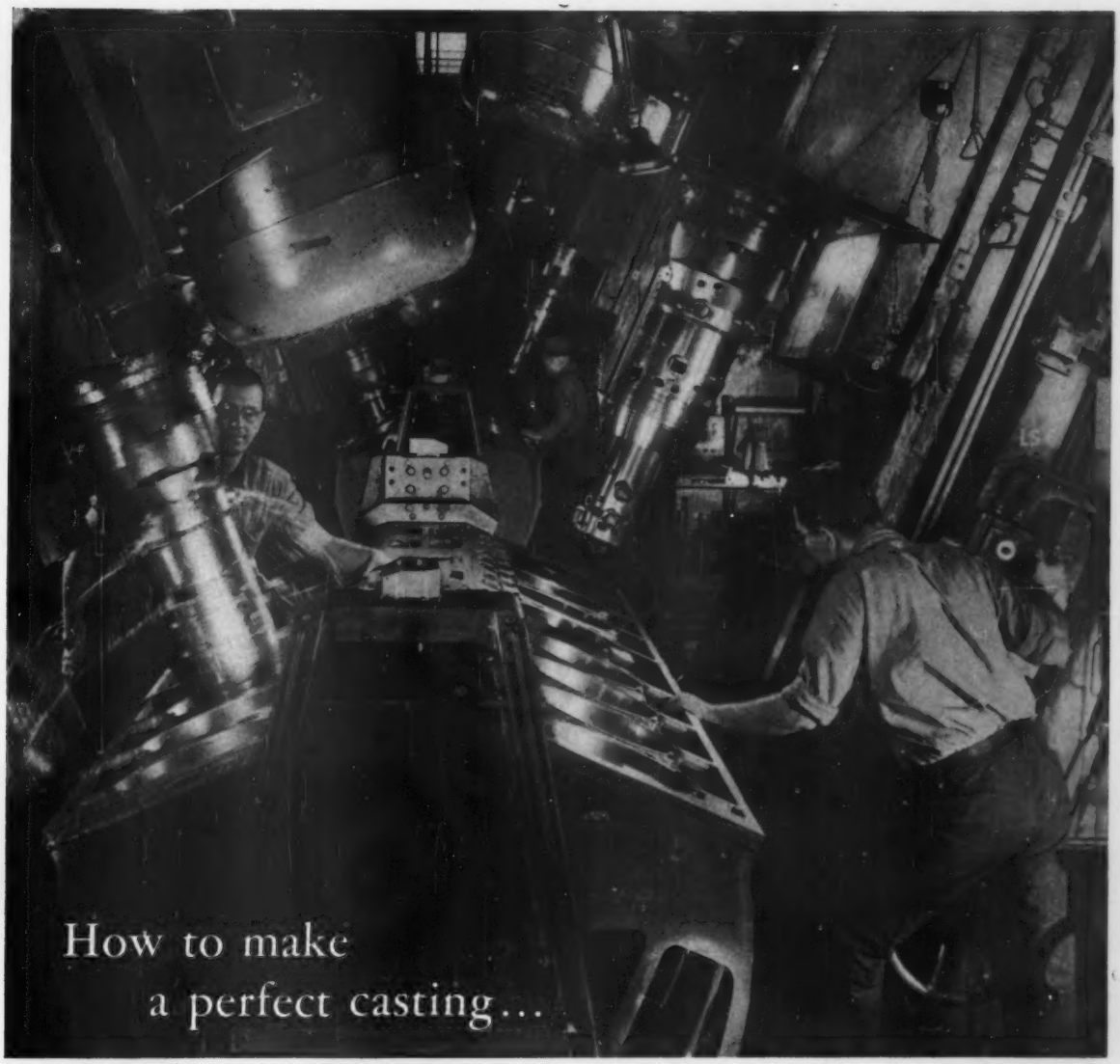
Long before the unit was shut down the customer had ordered new main bearings to keep in reserve stock in event of emergency. It was decided to install the new bearings while the compressor was torn down for inspection. When the old bearings were removed they were checked for wear and were found to be within the original one-thousandth-inch tolerance *for new bearings*. This means that there was *no measurable wear*, even after the equivalent of 20 years of "normal" operation!

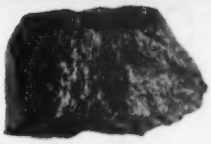
Of course, these are not ordinary bearings. They are *aluminum full-floating* bearings, one of the extra-value features found only in Ingersoll-Rand compressors. These heavy-duty bearings roll with the punch of each compressor stroke, distributing the load evenly all around the inside and outside of the shell. Their special aluminum alloy has better load-carrying capacity and higher heat conductivity than other bearing materials. And they *never need adjustment*, so the running gear may be kept sealed from dust and dirt.

Ingersoll-Rand compressors have many more extra-quality features that can save you money in your plant. Call your I-R representative—he has the solution for any compression problem.

The World's Most Comprehensive Compressor Experience . . . **Ingersoll-Rand**

I-982 ♥ 11 Broadway, New York 4, N. Y.





. . . start with V-5 Foundry Alloy! Vancoram V-5 Foundry Alloy is a special chromium alloy ideally balanced with manganese and silicon. It makes the improvement of gray cast irons easy and economical. Only a small addition improves mechanical properties, density, uniformity. Chill is reduced, too, without the formation of open structure in heavier sections. No chilled corners or edges, either. End results? Dense, tough castings of controlled microstructure which machine superbly! All the facts about this unique, better alloy for irons are contained in our V-5 Foundry Alloy brochure. Write for your copy . . . or call your nearest VCA District Office. Vanadium Corporation of America, 420 Lexington Avenue, New York 17, N. Y. • Chicago • Cleveland • Detroit • Pittsburgh

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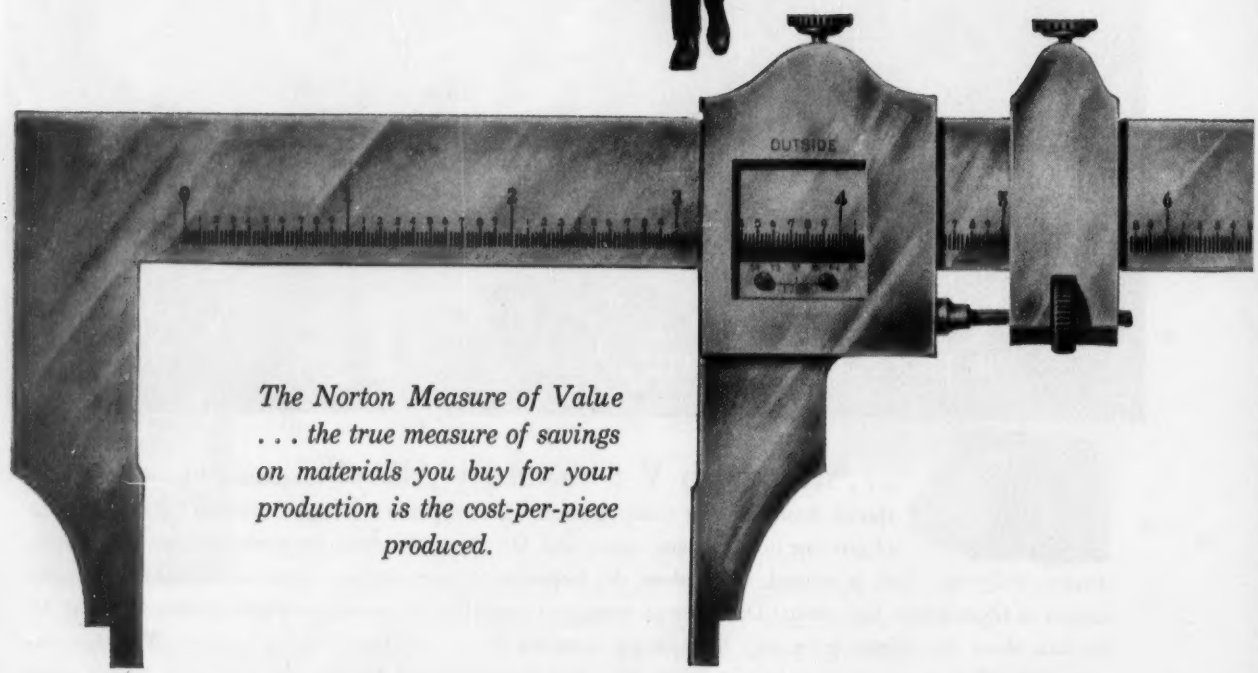
VANADIUM
CORPORATION OF AMERICA
Producers of alloys, metals and chemicals

VANCORAM

Circle 575 on Page 53

Call your Norton Man — he has the experience, the products, and knows how to save you money where it counts. There's a Norton expert in the fields of — abrasives, grinding machines, refractories.



The Norton Measure of Value . . . the true measure of savings on materials you buy for your production is the cost-per-piece produced.

You can produce greater savings than you can buy

Economists could argue the definition of the value of a grinding wheel in many ways. But it would usually come down to this — What is it worth to the purchaser.

You can buy less expensive grinding wheels than Norton wheels and save on immediate cost. But if the lower cost wheels do not perform their jobs efficiently or cause production delays because of poor quality or wheel misapplication — you haven't made a bargain — you've made a costly mistake.

The only accurate measure of the value of a grinding wheel is how much it produces for you per dollar cost — not merely how much you paid for it. Here is why Norton grinding wheels are worth more to you —

Norton Company gives you the most advanced research engineering and manufacturing facilities in the entire abrasive field — and you get this great scope of detailed knowledge on a personal basis — your Norton Man.

Every Norton Man starts his career by spending a minimum of one year in a carefully planned training course in the Norton plant and a comparable period of training in the field to assure a broad, thorough understanding of grinding before he goes "on his own." The average experience of all Norton Men in the field is 15 years in addition to their specialized training. The Norton Man is the most knowledgeable man in abrasives that you can consult. Make him your consulting abrasive engineer.

He will make an Abrasive Requirement Study for you.

This study lists the correct specifications for each abrasive job in your plant to assure you lowest cost-per-piece produced. He is also available for complete field testing on specific problems.

For example, your Norton Man can increase production by pointing out ways for better wheel usage and fewer wheel changes. He has the widest selection of grinding wheels in the industry from which to select the best wheel for new product grinding operations and for improving your current grinding jobs — both at the lowest cost. And with Norton grinding wheels you can be sure of precise duplication order after order.

Norton offers true abrasive economy. Economy that pays off in lower cost-per-piece produced. Call your Norton Man. NORTON COMPANY, General Offices, Worcester 6, Mass.

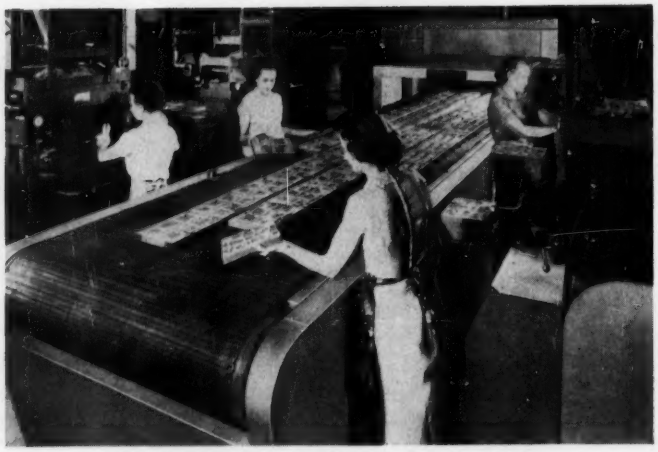
W-1893

NORTON
ABRASIVES

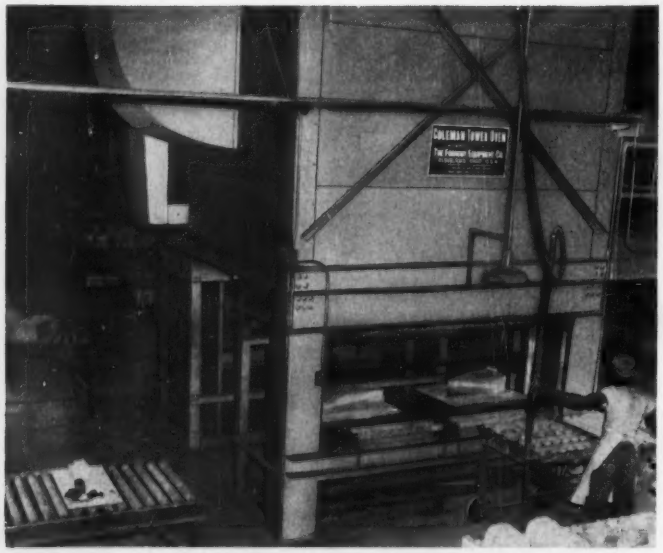
Making better products... to make your products better

Circle 576 on Page 53

CUT LABOR COSTS with Coleman Conveyor Core Ovens



Coleman Dielectric Core Oven in leading plumbing fixture foundry. Direct labor alone reduced by 75%, with many other important savings and advantages.



One of two large Coleman Tower® Core Ovens in a major steel foundry baking cores up to 150 pounds. Self-amortizing investment . . . ovens paid for themselves out of direct annual savings in less than two years.

● Performance records in all types of foundries prove that Coleman Conveyor Core Ovens reduce core department costs by as much as 50%.

Coleman Ovens quickly pay for themselves out of direct savings in labor, materials and reduced casting scrap.

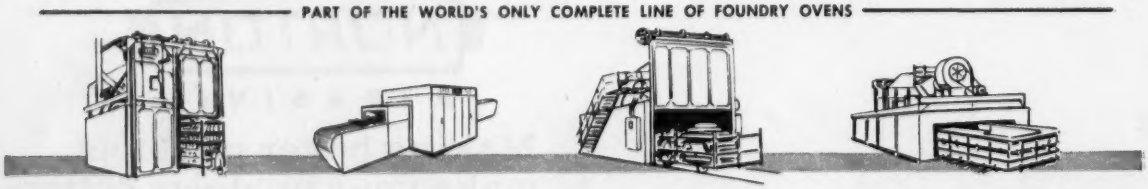
As builders of the world's only complete line of foundry ovens . . . dielectric or recirculating heat . . . we can recommend, without bias, the right oven for your particular needs.

WRITE FOR BULLETIN 54

THE FOUNDRY EQUIPMENT COMPANY • **1821 COLUMBUS ROAD, CLEVELAND 13, OHIO**

World's Oldest and Largest Foundry Oven Specialists—More than half a century of specialized foundry experience.

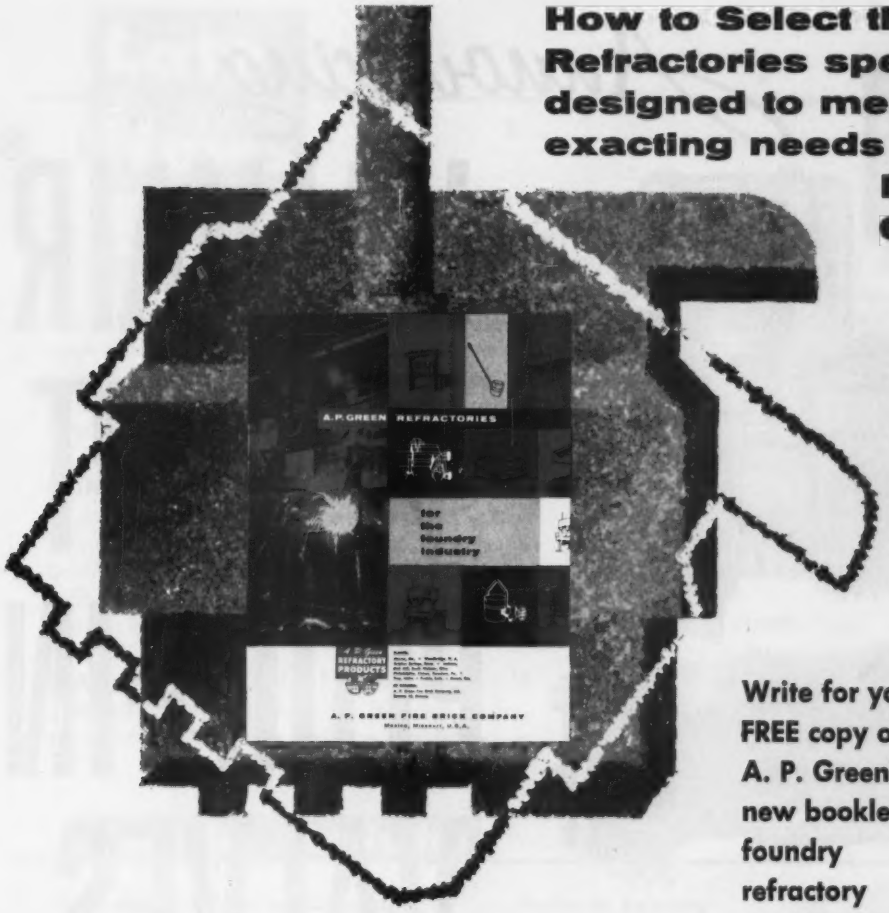
PART OF THE WORLD'S ONLY COMPLETE LINE OF FOUNDRY OVENS



TRANSRACK OVENS **DIELECTRIC CORE OVENS** **CAR TYPE OVENS** **JET ACTION MOLD OVENS**

Circle 577 on Page 53

How to Select the Refractories specifically designed to meet the exacting needs of your Foundry Operation



Write for your FREE copy of A. P. Green's new booklet of foundry refractory applications

For almost half a century the A. P. Green Company has been a leader in developing refractories to meet the exacting needs of the Foundry Industry. When your A. P. Green representative recommends a particular type of lining, you're sure of the finest refractories modern research can develop . . . specifically designed to give you maximum service at lowest cost.

50
FIFTY YEARS OF PROGRESS

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Please send me a copy of your new booklet, "Refractories for the Foundry Industry".

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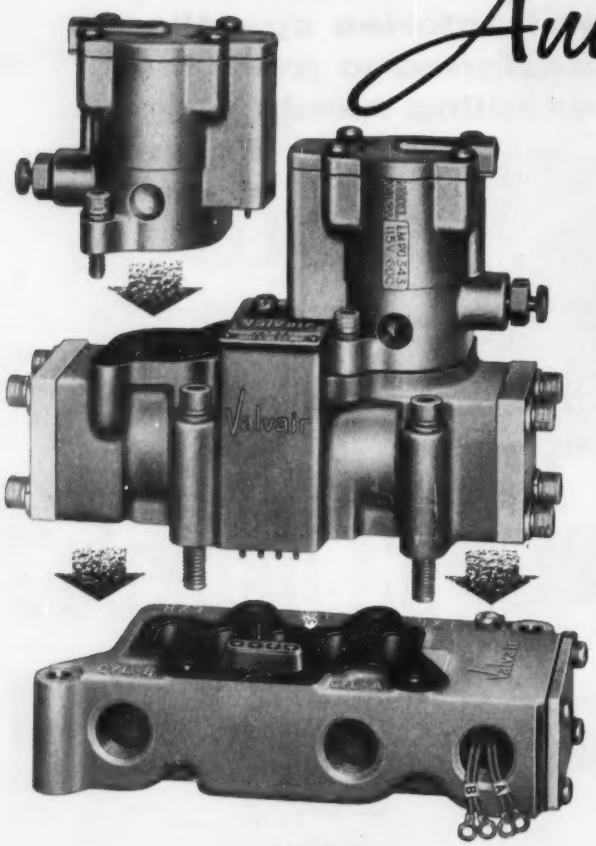
Firm Name_____
Address_____
City_____ Zone____ State_____

Circle 578 on Page 53

Announcing

VALVAIR®
½" NPT
PLUG-IN
VALVES



MODEL PD-441 shown. 4-way single or double pilot-operated types, for sub-base or manifold mounting. Aluminum and stainless steel components assure multi-million cycle dependability. Interchangeable pilots, with coils guaranteed against burn-out for life of valve, fit any plug-in Speed King. Coils for ac or dc, any voltage . . . 35 — 200 psi range . . . integral junction box . . . optional manual over-ride, common or separate exhaust ports, sub-base connected external pilot supply . . . ¾ in. exhaust ports, ½ or ¾ in. inlet and cylinder ports . . . valve meets JIC standards.

Based on the service-proved design principle of the Speed King ¼ in. plug-in Valvair's ½ - ¾ in. plug-in valve series provides plug-in convenience and versatility to a wider range of control valve applications.

Electrical and pneumatic circuits are completed automatically when valve and pilot are plugged in . . . bolted down. The result — cost-cutting reduction of original installation and maintenance time. All power connections are made permanently in sub-base or manifold . . . there's no need to disturb piping or wiring for quick in-service maintenance.

What's more, advanced design shortens stroke . . . speeds response. Separate coded (4-wire) circuits on double solenoid models meet JIC requirements. Flow area through valve and sub-base equals that of full ½ in. pipe.

Whether your control valve applications are on the drawing board or now in service, it'll pay you to investigate the advantages of Valvair plug-in design. A call to your near-by Valvair field office will bring prompt application engineering recommendations.

For more information, write for Bulletin SPL. Address Dept. FO-160, Valvair Corporation, 454 Morgan Ave., Akron 11, Ohio

Valvair AKRON 11, OHIO

A UNIT OF INTERNATIONAL BASIC ECONOMY CORPORATION

Other INDUSTRIAL DIVISIONS of IBEC: The Sinclair-Collins Valve Co. The Bellows Co., Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio.

8098

Late News

ALUMINUM UP: Leading producers have raised the price of basic aluminum 1.3 cents a pound. The market now is back to the level prevailing on April 1, 1958, when a 2-cent cut was made. On Aug. 1, 1958, a 0.7-cent increase was made. The latest advance also is reflected in higher prices on secondary ingot.

CLINICS: Gray Iron Founders' Society has announced a series of new regional Sales Refresher Clinics and a repeat of its popular basic Sales Training Clinics, starting early in 1960. Casting Design Clinics for customers will start in additional areas in April.

TRAINING PROGRAM: A new series of 16 practical training courses for foundry technicians and supervisors will be conducted in 1960 by the Training and Research Institute of the American Foundrymen's Society. The first course, on cupola melting, will be held Jan. 11-15 at Chicago and will be followed by one there Feb. 3-5 on gating and risering.

PIPE MEN ELECT: Cast Iron Soil Pipe Institute has elected C. A. Hamilton, Alabama Pipe Co., Anniston, Ala., president. Other officers chosen are H. E. Robertson, executive vice president, and J. J. Flynn, Central Foundry Co., Holt, Ala., vice president.

DIECASTING SHIFT: Dow Metal Products Co., division of Dow Chemical Co., has transferred its magnesium and aluminum diecasting operations from Midland to Bay City, Mich. This move consolidates all of Dow's sand and

Foundry Statistics

Iron and Steel Scrap Consumption

(Gross tons*)

	All Scrap Total	By Types of Furnace — Cupola Total	Air Total	Electric Total
1957	65,688,592	9,220,405	1,026,951	8,876,400
1958				
June	4,409,006	615,271	62,703	605,733
6 mo.	22,982,262	3,751,164	390,428	3,347,626
July	3,716,739	543,726	47,203	513,394
Aug.	4,203,034	550,844	66,877	592,727
Sept.	4,472,219	589,860	71,198	637,400
Oct.	5,091,207	707,378	90,707	757,722
Nov.	4,803,615	700,704	74,332	691,078
Dec.	4,973,670	741,494	80,593	712,779
Total	50,242,746	7,725,970	821,388	7,152,726
1959				
Jan.	5,375,042	783,045	86,519	767,289
Feb.	5,657,873	791,137	88,326	801,692
Mar.	6,677,499	873,982	101,986	965,048
Apr.	6,644,905	911,313	106,972	996,126
May	6,642,572	868,661	99,256	1,029,573
June	6,322,404	885,497	104,683	997,921
6 mo.	37,338,295	5,113,635	607,742	5,557,649

Index of Foundry Equipment Orders

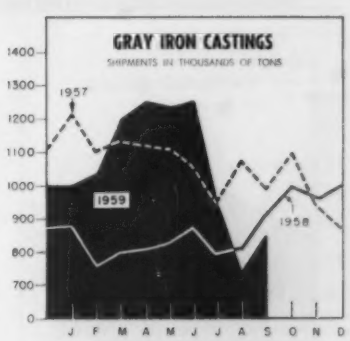
Foundry Trades Only

(Net Orders Closed, New Equipment)

	1958	1959
Jan.	57.9	127.4
Feb.	57.6	237.1
Mar.	85.9	166.6
Apr.	88.7	154.2
May	136.1	157.0
June	87.7	125.1
July	77.9	110.7
Aug.	74.1	134.1
Sept.	64.5	131.3
Oct.	118.9	140.8
Nov.	83.3	....
Dec.	137.0	....

Note: Base period 1947-49 taken as 100 per cent monthly average.

Source: Foundry Equipment Manufacturers Association.



GRAY IRON CASTINGS—SHIPMENTS

(Net tons)[1]

	All Castings — Total	All Castings — For Sale	Miscellaneous Castings Total	Miscellaneous Castings For Sale	Nodular Iron Castings Total	Heavy Steel Ingot Molds Total	Chilled Railroad Car Wheels Total	Pressure Pipe & Fittings Total[3]	Soil Pipe & Fittings Total[3]	Unfilled Orders[2]
1957	12,664,504	6,876,497	7,786,229	3,310,915	.....	2,409,290	359,332	1,351,345	755,308	.....
1958										
Sept.	916,704	537,717	518,185	227,414	7,902	175,323	20,783	125,693	76,720	644,534
9 mo.	7,422,588	4,252,751	4,399,692	1,926,177	81,928	1,266,250	205,322	984,805	586,519	.....
Oct.	992,730	586,614	551,380	253,062	10,857	207,500	22,970	129,375	81,505	619,667
Nov.	958,306	505,290	575,586	231,669	11,731	201,704	18,801	98,326	63,889	602,375
Dec.	997,608	509,499	628,720	246,289	13,072	208,942	18,021	85,179	56,746	608,096
Total	10,371,232	5,863,154	6,155,378	2,657,197	117,588	1,884,396	265,114	1,277,655	783,659	.....
1959										
Jan.	1,001,771	517,390	625,604	250,161	12,061	214,985	27,650	75,571	58,056	637,245
Feb.	1,036,655	538,514	642,882	252,115	12,619	230,706	31,035	76,147	55,885	767,360
Mar.	1,205,572	666,034	701,527	286,692	13,881	270,293	35,820	108,131	89,801	846,937
Apr.	1,245,702	688,755	726,105	295,982	14,663	270,476	35,655	129,861	83,605	892,214
May	1,236,250	685,285	706,073	285,507	16,003	275,563	36,960	141,675	75,979	884,779
June	1,252,016	717,067	707,291	295,064	15,510	268,479	30,723	160,540	84,983	836,707
July	943,486	532,976	602,261	252,907	14,508	107,604	20,486	133,175	79,960	897,536
Aug.	743,564	506,756	485,444	254,232	11,046	13,482	18,479	145,853	80,308	872,993
Sept.	850,043	528,145	595,425	279,357	11,875	19,416	16,272	142,660	76,260	883,278
9 mo.	9,515,089	5,380,922	5,792,622	2,452,017	122,166	1,671,004	253,080	1,113,612	684,835	.....

*Source: U. S. Dept. of Interior Bureau of Mines. [2]Source: Bureau of Census. [3]For sale only. [4]All cast iron pipe is shipped for sale.

Late News

metal mold casting facilities at Bay City. Die-casting will be carried on in a remodeled building in which new melting and handling equipment has been installed.

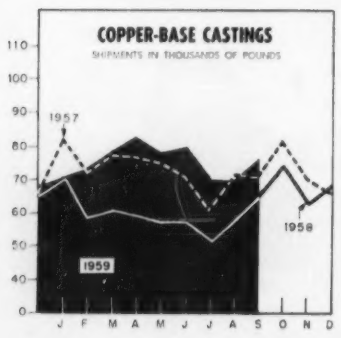
ALUMINUM USE: Motor vehicles took 68 per cent of all the aluminum permanent mold castings produced during the first half of 1959 by members of the Aluminum Association. This was a 10-point increase over the 1958 period. Next largest outlet was home appliances with 7.6 per cent. On the other hand, motor vehicles accounted for only 14 per cent of all sand castings, largest users of which were machines, equipment, and tools (36.4 per cent) and national defense (25.5 per cent).

CAR BACKLOG UP: Freight car builders had unfilled orders for 36,555 cars on Dec. 1, compared with 27,962 a year ago. November orders totaled 2624 cars, against 2722 in October and 6295 in November, 1958.

MATERIAL HANDLING: Sales of industrial material handling equipment will show an increase of 15 to 25 per cent in 1960. This is the forecast made by equipment manufacturers in a survey conducted by the Material Handling Institute. Most of the gain is looked for during the second half of the year. Sales during the first ten months of 1959 were 23 per cent ahead of the 1958 period. Many manufacturers plan the introduction of new equipment in 1960.

PERSONALS: Victor M. Rowell has joined Federal Foundry Supply Div., Archer-Daniels-Midland Co., Cleveland, as new products manager. Daniel R. Chester has been appointed general manager, product and service department, and John M. Sweeney is technical service manager . . . Dr. Walter A. Dean has been named assistant director of reseach, Aluminum Co. of America, Pittsburgh . . . Fred D. Crowther has been elected vice president and general manager, Chapman Valve Mfg. Co., Springfield, Mass. Chapman is a wholly owned subsidiary of Crane Co., Chicago . . . John F. Torley has been appointed vice president, manufacturing, Industrial Div., National Malleable & Steel Castings Co., Cleveland . . . Elton E. Staples, vice president, Hevi-Duty Electric Co., Milwaukee, will be in charge of

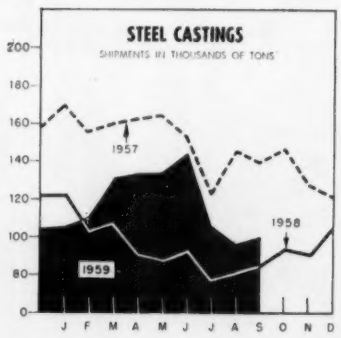
Foundry Statistics



COPPER-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments			
	Total	Sand	Perm. Mold	Unfilled Orders[2]
1957	874,627	789,014	44,789	.....
1958				
Sept.	64,447	58,435	2,888	25,655
9 mo.	535,522	484,804	27,051	.....
Oct.	74,012	67,564	3,239	26,726
Nov.	62,746	57,386	2,604	24,928
Dec.	67,905	61,119	3,535	25,078
Total	740,155	670,873	36,429	.....
1959				
Jan.	70,123	62,266	3,753	25,344
Feb.	72,754	64,558	4,007	26,468
Mar.	78,641	69,472	4,333	29,373
Apr.	82,799	73,567	4,640	29,941
May	78,413	69,351	4,363	27,074
June	79,366	70,512	4,421	30,389
July	69,073	61,650	3,869	31,820
Aug.	68,979	60,346	4,410	32,117
Sept.	76,045	66,517	4,810	29,396
9 mo.	676,193	598,239	38,606	.....



STEEL CASTINGS—SHIPMENTS

(Net tons[1])

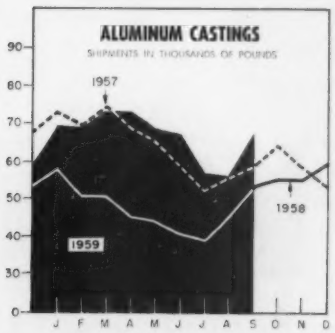
	All Castings			Carbon			Alloy			
	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Total	For Sale	Railway Specialties	Unfilled Orders[2]
1957	1,766,191	1,359,747	349,059	1,328,478	1,019,090	324,951	437,713	340,657	24,108	.....
1958										
Sept.	85,277	64,586	9,205	60,392	44,890	7,905	24,885	19,696	1,300	196,482
9 mo.	836,544	636,693	114,555	598,132	450,196	104,836	238,412	185,975	9,719	.....
Oct.	95,389	73,367	12,254	67,906	51,065	10,980	27,483	22,302	1,274	184,925
Nov.	85,267	65,786	9,648	59,793	45,808	8,501	25,474	19,980	1,147	193,960
Dec.	103,800	81,360	13,187	76,015	59,171	11,934	27,785	22,189	1,253	214,352
Total	1,121,000	856,986	149,644	801,846	606,240	136,251	319,154	250,746	13,393	.....
1959										
Jan.	105,392	82,683	14,408	76,242	59,027	12,948	29,150	23,656	1,460	232,646
Feb.	110,280	86,013	14,686	79,365	61,261	13,316	30,645	24,752	1,370	245,096
Mar.	131,317	103,848	20,086	93,309	75,968	18,410	35,008	27,880	1,676	270,682
Apr.	134,344	104,890	21,372	99,295	76,802	19,761	35,049	28,088	1,611	271,613
May	135,359	105,804	23,825	101,504	78,767	22,498	33,855	27,037	1,327	263,969
June	143,624	111,725	26,567	107,000	82,485	24,568	36,624	29,240	1,999	248,782
July	106,790	83,541	16,007	78,316	60,502	14,520	28,474	23,039	1,487	274,065
Aug.	98,014	79,188	17,607	74,825	60,243	14,373	23,189	18,945	1,234	279,261
Sept.	99,731	79,963	13,975	73,648	58,453	12,830	26,083	21,510	1,145	256,871
9 mo.	1,064,851	837,655	168,533	783,504	613,508	155,224	278,077	224,147	13,309	.....

[1]Source: Bureau of the Census. [2]For sale only.

all operations concerning manufacture of industrial and laboratory heating equipment . . . John F. Oettinger, Electric Steel Foundry Co., Portland, Oreg., has been named works manager of the company's subsidiary, Pacific Alloy Corp., El Cajon, Calif. . . . Henry G. Magnussen, former Lindberg Engineering Co. official, has been named adviser to the director of the Metal Working Equipment Div., BDSA, Washington . . . J. W. Drydyk has been made vice president in charge of plant operations and W. A. Eckhart, vice president in charge of sales, Meta-Mold Aluminum Co., Cedarburg, Wis.

OBITUARY: Hugh Martin, 69, president, Martin Foundry Co., Detroit, died Dec. 11 . . . I. T. Kahn, 78, board chairman, Consolidated Iron-Steel Mfg. Co., Cleveland, died Dec. 12. Taylor-Boggis Foundry Co., Cleveland, is a subsidiary of Consolidated Iron-Steel . . . I. E. Shaer, Boston representative, Claude B. Schneible Co., Detroit, died Nov. 22 . . . Julius Pollack, 76, former secretary-treasurer, Republic Brass Co., Cleveland, died Nov. 11 . . . Robert R. Schultz, 50, executive vice president and general manager, Rogers Iron Works Co., Joplin, Mo., died Dec. 6 . . . Archibald McKinley, 88, retired chairman, Griffin Wheel Co., Chicago, died Dec. 14.

MISCELLANY: Tyler Pipe & Foundry Co., Tyler, Tex., plans expenditure of $500,000 on plant improvements in 1960 . . . Foundry Facings Manufacturer's Association has appointed Herington Advertising Inc., New Rochelle, N. Y., to act in the capacity of executive secretary of the association . . . The more than 10,000 research projects being conducted at 118 engineering colleges represent an expenditure of over $112 million during the current year . . . Reynolds Metals Co. will build a silicon plant at its aluminum reduction plant near Sheffield, Ala. Its annual capacity of 5000 tons will provide metal for silicon-aluminum casting alloys . . . Crown Pipe & Foundry Co., Jackson, Ohio, has been reorganized and plans resumption of soil pipe production in February after having been closed since 1956 . . . Aluminium Ltd., Montreal, has bought Apex Smelting Co., Chicago, for nearly $12 million worth of Aluminium stock. Apex also has plants in Cleveland and Los Angeles. No changes in personnel are contemplated.



PRODUCTION WORKERS

Estimated Number

	Sept. 1959	Aug. 1959	Sept. 1958
Ferrous	195,700	194,100	164,800
Nonferrous	54,300	52,900	47,700

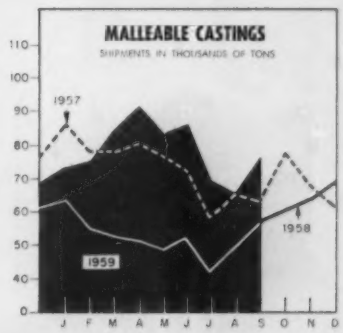
Average Weekly Earnings

Gray Iron	$95.76	$94.80	$87.25
Malleable Iron	93.84	95.34	88.94
Steel	93.16	100.19	92.61
Nonferrous	100.86	99.39	95.18

Average Weekly Hours

Gray Iron	39.9	40.0	38.1
Malleable Iron	39.1	40.4	38.5
Steel	38.8	39.6	37.8
Nonferrous	41.0	40.9	40.5

Source: Bureau of Labor Statistics.



ALUMINUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments Total	Sand	Perm. Mold	Die	Unfilled Orders[2]
1957	751,818	143,991	232,326	373,586	.....
1958					
Sept.	52,796	10,261	16,241	26,254	72,819
9 mo.	425,477	85,076	132,498	206,946	.....
Oct.	55,699	10,932	17,189	27,511	73,474
Nov.	55,793	10,539	16,942	28,264	76,370
Dec.	59,487	10,874	18,970	29,579	78,732
Total	596,456	117,421	195,599	292,300	.....
1959					
Jan.	68,896	11,238	24,844	32,813	83,314
Feb.	68,381	10,802	25,428	32,147	82,001
Mar.	73,351	12,412	26,964	33,949	82,676
Apr.	72,976	12,700	26,153	33,992	85,636
May	68,268	11,979	25,283	30,877	80,325
June	66,479	12,312	24,927	29,092	81,228
July	56,911	11,581	20,410	24,786	80,450
Aug.	55,904	11,130	17,824	26,818	82,488
Sept.	68,193	12,309	21,506	32,239	81,839
9 mo.	597,359	106,463	213,339	276,713	.....

[1]Source: Bureau of the Census. [2]For sale only.

MALLEABLE IRON CASTINGS

(Shipments of castings—net tons[1])

	Shipments Total	For Sale	Standard Total	For Sale	Pearlitic Total	For Sale	Unfilled Orders[2]
1957	862,976	520,118	713,539	431,662	149,437	88,456	.....
1958							
Sept.	56,836	31,999	45,945	26,370	10,891	5,629	58,405
9 mo.	467,338	269,563	386,549	220,313	81,369	48,250	.....
Oct.	60,951	40,014	50,181	31,992	10,800	8,022	63,425
Nov.	63,356	35,221	50,063	28,409	13,293	6,812	66,725
Dec.	68,385	40,041	53,797	32,883	14,588	7,158	65,904
Total	660,650	383,839	540,600	313,597	120,050	70,242	.....
1959							
Jan.	73,186	43,667	56,700	35,139	16,486	8,528	77,322
Feb.	74,769	42,093	57,573	31,976	17,187	10,117	90,291
Mar.	84,335	49,690	67,439	40,515	16,896	9,175	95,822
Apr.	90,974	54,306	75,583	43,835	15,391	10,471	102,508
May	83,472	49,619	66,512	40,438	16,960	9,181	99,879
June	83,497	51,411	68,426	42,453	17,071	8,958	95,339
July	69,154	43,128	55,120	35,787	14,064	7,341	75,252
Aug.	65,062	40,143	53,217	33,224	11,845	6,919	85,852
Sept.	76,063	46,469	60,209	36,619	15,854	9,850	82,274
9 mo.	702,533	420,496	560,779	339,986	144,754	80,540	.....

Prices of Foundry Metals and Coke

(As of Dec. 22, 1959)

FOUNDRY COKE

(Per net ton, f.o.b. ovens)

BEEHIVE

Connellsville	$18.00-18.50

OVEN

Birmingham	$30.35
Buffalo	32.00
Detroit	32.00
Erie, Pa.	32.00
Indianapolis	31.25
Kearny, N. J.	31.25
Milwaukee	32.00
Neville Island (Pittsburgh)	30.75
New England, deld.	33.55
New Haven, Conn.	31.00
Painesville, O.	32.00
Philadelphia	31.00
St. Louis	33.00
St. Paul	31.25
Swedeland, Pa.	31.00
Terre Haute, Ind.	31.25

PIG IRON

(Per gross ton, f.o.b. furnace)

	No. 2 Foundry	Malleable
Birdsboro, Pa.	$68.50	$69.00
Birmingham	62.50	66.50
Buffalo	66.50	67.00
Chester, Pa.	68.50	69.00
Chicago	66.50	66.50
Cleveland	66.50	66.50
Duluth	66.50	66.50
Erie, Pa.	66.50	66.50
Everett, Mass.	68.00	68.50
Fontana, Calif.	75.50	....
Geneva, Utah	66.50	....
Granite City, Ill.	68.40	68.90
Neville Island (Pittsburgh)	66.50	66.50
Swedeland, Pa.	68.50	69.00
Toledo, O.	66.50	66.50
Troy, N. Y.	68.50	69.00
Youngstown, O.	....	66.50

NONFERROUS INGOT

(Cents per pound, carlots)

BRASS AND BRONZE: Red brass, No. 115, 30.75; tin bronze, No. 225, 41.50; No. 245, 36.00; high-leaded tin bronze, No. 305, 35.25; No. 1 yellow, No. 405, 24.75; manganese bronze, No. 421, 29.25.

ALUMINUM: 99 per cent plus primary ingots 28.10. Secondary No. 12 alloy, 25.00. Deoxidizing grades: No. 1, 25.75; No. 4, 22.75.

MAGNESIUM: 99.8 per cent notched ingots 36.00, f.o.b. Velasco, Tex. (10,000 lb or more).

COPPER: Electrolytic 33.00, delivered Connecticut valley.

ZINC: High grade 13.75, delivered. Die casting alloy No. 3, 15.75; No. 2, 16.25, delivered.

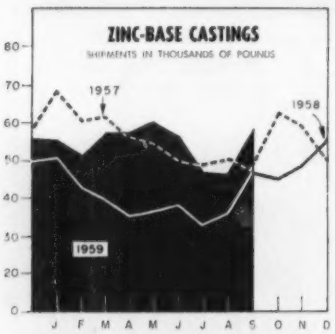
Iron and Steel Scrap

(Consumer prices per gross ton delivered, except as otherwise noted)

	No. 1 Heavy Melting Steel	No. 1 Cupola Cast	Heavy Breakable Cast	Clean Auto Cast	Machinery Cast	Malleable	Short Steel Rails
Birmingham	$36.00–37.00	$53.00–54.00	.....	.....	.....	.....	$56.00–57.00
Boston*	**35.00–36.00	**39.00–40.00	.....	.....	**40.00–43.00	.....	.....
Buffalo	37.00–38.00	**47.00–48.00	.....	.....	**51.00–52.00	.....	53.00–54.00
Chicago	41.00–42.00	54.00–55.00	.....	60.00–61.00	60.00–61.00	62.00–63.00	59.00–61.00
Cincinnati*	**36.00–37.00	**49.00–50.00	**44.00–45.00	.....	**59.00–60.00	.....	**63.00–64.00
Cleveland	40.00–41.00	55.00–56.00	41.00–42.00	58.00–59.00	58.00–59.00	64.00–65.00	65.00–67.00
Detroit*	**37.00–38.00	**46.00–47.00	**40.00–41.00	**53.00–54.00	.....	.....	.....
Los Angeles*	41.00	47.00	.....	.....	.....	.....	.....
New York*	36.00–37.00	38.00–39.00	37.00–38.00	.....	.....	.....	.....
Philadelphia	42.00	45.00	47.00	.....	54.00–55.00	68.00	.....
Pittsburgh	41.00–42.00	50.00–51.00	.....	47.00–48.00	54.00–55.00	.....	65.00–67.00
St. Louis*	35.00–37.00	53.00	44.00	56.00	.....	.....	56.00
San Francisco	40.00	48.00	28.00	40.00	40.00	.....	.....
Seattle	35.00	34.00	28.00	.....	.....	.....	.....

*Brokers' buying prices. **F.o.b. shipping point

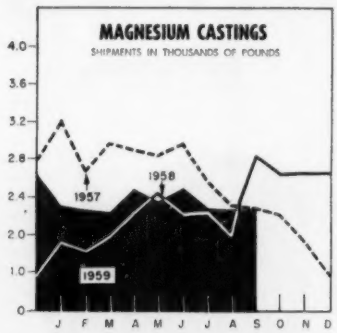
Foundry Statistics



PIG IRON

PRODUCTION—Net Tons

	Foundry	Malleable & Silvery	Low & Int. Low Phos. & Bessemer
1957	2,275,789	3,697,335	7,452,203
1958			
July	123,075	156,582	402,850
7 mo.	871,966	1,315,974	2,690,637
Aug.	141,185	145,216	396,511
Sept.	133,556	234,752	416,026
Oct.	146,386	257,111	575,806
Nov.	175,210	257,131	489,095
Dec.	154,007	272,375	429,299
Totals[3]	1,622,320	2,448,917	4,954,854
1959			
Jan.	190,392	263,105	479,019
Feb.	121,716	258,250	312,284
Mar	173,881	341,218	412,533
April	159,950	296,384	427,227
May	198,126	358,087	474,820
June	188,158	346,231	441,052
July	.....	.....	.....
7 mo.	.....	.....	.....



ZINC-BASE CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1957	669,775	431,509	.....
1958			
Sept.	47,127	33,520	50,762
9 mo.	359,101	242,377	.....
Oct.	45,045	36,103	58,154
Nov.	48,431	34,054	57,884
Dec.	55,600	39,768	56,756
Total	508,177	352,302	.....
1959			
Jan.	55,439	38,661	61,192
Feb.	51,368	35,478	57,437
Mar.	57,600	40,700	62,657
Apr.	57,325	40,127	55,916
May	60,656	43,920	62,224
June	56,128	40,226	54,097
July	46,756	34,606	52,677
Aug.	46,566	34,682	56,090
Sept.	58,144	40,397	60,953
9 mo.	489,982	348,797	.....

CONSUMPTION*—Gross Tons

	Cupola	Air	Electric
1957	4,160,891	218,178	246,851
1958			
June	262,883	12,098	15,549
6 mo.	1,619,040	81,662	67,817
July	239,140	10,550	12,140
Aug.	247,428	13,196	32,309
Sept.	300,173	14,994	27,759
Oct.	300,115	17,393	34,273
Nov.	287,013	14,862	31,397
Dec.	321,741	16,610	25,450
Total	3,314,652	169,267	231,145
1959			
Jan.	321,302	17,113	36,783
Feb.	324,876	17,960	37,414
Mar.	353,985	20,625	42,464
Apr.	366,378	21,997	41,597
May	358,192	20,424	40,812
June	366,136	20,390	39,867
6 mo.	2,090,869	118,509	238,937

MAGNESIUM CASTINGS

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1957	30,322	28,452	.....
1958			
Sept.	2,804	2,581	6,083
9 mo.	19,374	18,131	.....
Oct.	2,627	2,479	5,463
Nov.	2,615	2,523	4,063
Dec.	2,612	2,384	5,115
Total	27,228	25,517	.....
1959			
Jan.	2,291	2,086	5,001
Feb.	2,249	1,995	4,637
Mar.	2,129	1,924	4,465
Apr.	2,455	2,213	4,787
May	2,370	2,093	5,102
June	2,484	3,207	4,664
July	2,265	1,875	5,995
Aug.	2,243	1,753	3,809
Sept.	2,263	1,832	3,823
9 mo.	20,749	18,978	.....

*Source: U. S. Dept. of Interior, Bureau of Mines. **Source: American Iron & Steel Institute. [1]Source: Bureau of the Census. [2]For sale only. [3]Monthly figures do not add up to totals shown because of unreported monthly revisions.

For Cleaner Surfaces, Better Shakeout, Try

WHITEHEAD'S NEW HYGEIA LYQUAFLOUR

Our new plant at Irwin, Pa., is producing the improved DUSTLESS DOUBLE STRENGTH HYGEIA LYQUAFLOUR. The compound of a special hydrocarbon and woodflour improves castings and mold conditions for all types of metal. Highly recommended for the advantages listed below:

- One sand additive controls both peel and expansion
- Good shakeout saves sand
- Imparts highest flowability to sand mixture to give pattern true finish
- 2% initial treatment of sand and as little as ¼ of 1% to reactivate does the job
- Replaces any carbon or hydrocarbon materials now used
- Eliminates dust at the muller
- Castings peel excellently which reduces cleaning room time
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- Less ramming required, more molds per hour
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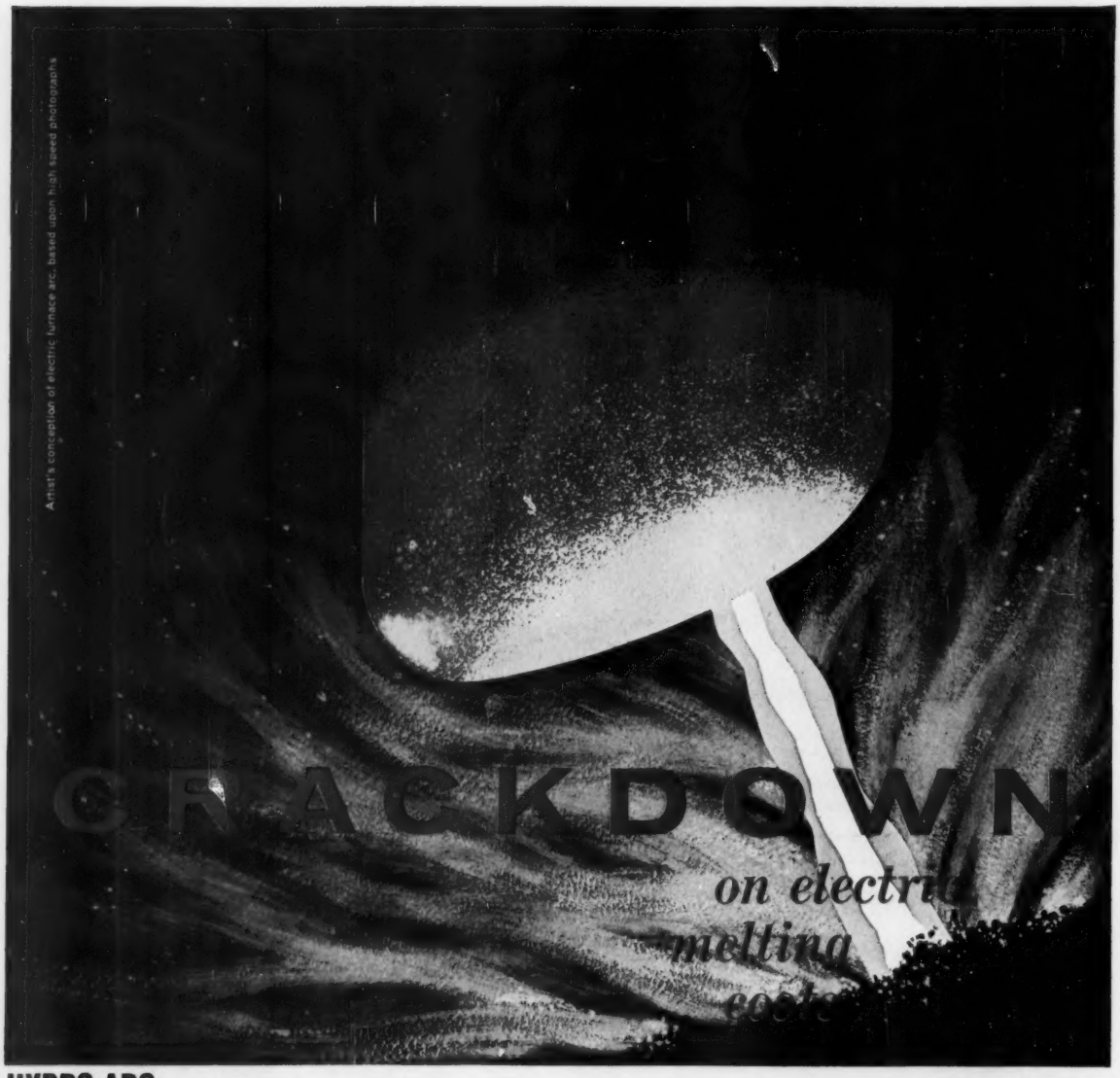

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Air counterbalanced electrodes and a unique dual motor hydraulic control circuit virtually eliminate troublesome inertia or mechanical lag. When turbulance in the metal charge effects arc gap, electrode reaction is immediate—readjustment is exact! Here is electric melting efficiency you may not have thought possible . . . cost reductions that open many new applications for fast, clean, economical electric melting. Hydro-Arc may put a fresh light on your own plans for additional melting, smelting, or other heating facilities.

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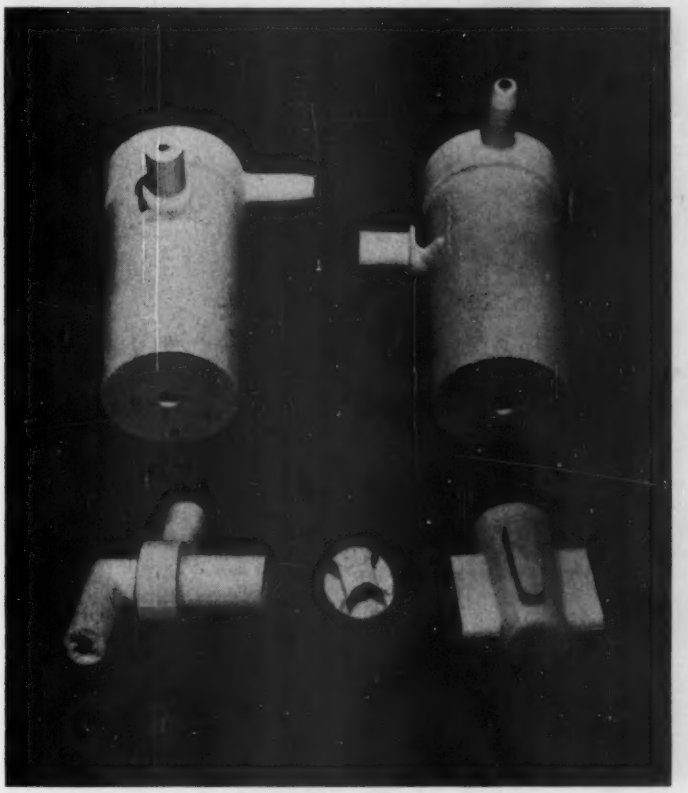
Circle 581 on Page 53

Get Lower Cost Castings . . .
Closer Tolerances and Smoother Finish



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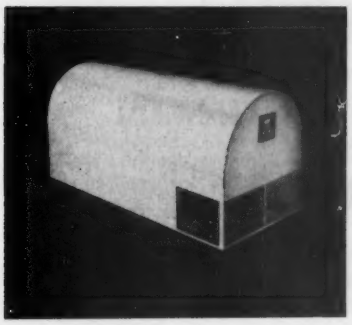
CARDOX® CO_2
SEMI-PRECISION
MOLDING PROCESS

This latest Cardox improvement in the CO_2 core hardening process can help you to produce castings with closer dimensional accuracy and smoother finish than has been possible with conventional methods. Providing full hardening of cores and molds in 15 to 30 seconds, it also eliminates the cost and space of core dryers and core storage, and enables faster production set-ups.

Combining the best features of shell molding with the proven CO_2 hardening process, this new advance is substantially reducing costs in many ferrous and non-ferrous foundries. It is increasing production with little or no capital outlay for new equipment. No major change in production methods is required.

Write today for reprints of the illustrated case history, "CO_2 Core Hardening Enables Two Pittsburgh Foundries to Improve Precision, Speed Production".



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AVAILABLE IN ANY FORM

Bulk Liquid Carbon Dioxide — The storage method originated and developed by Cardox. More Cardox Storage Units are used in industry than any other make. Storage Units are supplied without capital investment when user requirements warrant it, on a user contract basis . . . **Also CO_2 cylinder gas, dry ice and converters.**

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MINES AND MILLS IN THE WEDRON-OTTAWA DISTRICT

Circle 583 on Page 53

Newaygo Engineering Company — Leaders in

PALLET LINE SYSTEMS OF MOLD HANDLING

for Higher Mold Production at Lower Molding Costs!

As of October, 1959, heavy duty foundry installations in operation total close to TEN THOUSAND LINEAL FEET of Newaygo Pallet Line Systems, consisting of top set out track, automatic mold discharge, and underneath car return, — operating approximately 5,600 Pallet Cars; — which, using average rates of production for molders using these lines and cars, means that these Pallet Line Systems are producing an average of 42,500 molds per working day, for approximately 10,200,000 molds per year!

Projecting the average amount of metal poured in molds by these systems, around 1,200,000 pounds of castings are produced per day, or approximately 300,000,000 pounds or 150,000 net tons of castings per year.

One foundry reports the outstanding performance of Newaygo's Pallet Line System by averaging 450 molds per 7½-hour day per man, using a 14" x 16" x 12" deep mold. This yields a mold per minute per man, and each man is making the complete mold in snap flasks and setting his own cores.

FOUNDRY Magazine's October, 1959 issue established a base of 100% for purchases of foundry equipment during the 1947-49 period, and reported the growth index of 154% for the first seven months of 1959 for all producers of Foundry equipment. *Newaygo's per cent increase for the same period is 224%,* — another evidence of leadership as designers, manufacturers and installers of complete sand handling systems and foundry automation equipment.

Shown above is a view from the pouring floor of a 19-station midwest steel foundry, showing specially designed molding hoppers of Stainclad Steel with air-operated gates. Also shown is the mold storage end of the Pallet Car set-out track system. Molds are handled on pallet cars and are automatically dumped at end of lines into a vibrating pan conveyor. Pallet Cars and boards are automatically returned on an underneath track system.

The presentation of "NEWAYGO PALLET LINE SYSTEMS FOR MOLD HANDLING" is yours for the asking, in a 16mm, 25-minute MOVIE, which shows many types of Pallet Line installations in foundries.

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. . . and profitable, too, with **NEWAY® MOLD HANDLING, SAND HANDLING AND CONDITIONING EQUIPMENT**

Also Manufacturers and Installers of MULTI-LEVEL HOPPER CONTROL SYSTEMS, CAR CONVEYORS, APRON CONVEYORS, ROTARY FEEDERS, and FOUNDRY AUTOMATION.

Circle 584 on Page 53

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with H. V. ADAMS DESIGNED

HIGH EFFICIENCY FOUNDRY TOOLS

"UNIVERSAL FREE WHEELING"

FOUNDRY SAND RIDDLE

with the Double Eight Vibration

Because of its convenient size, light weight and good riddling capacity it long has been a favorite in the foundry. It also can be used for mixing core sand or for sifting sand directly into molds.

The mechanism is entirely enclosed protecting it from harmful dust and grit.

The main frame is cast in very strong tough aluminum.

It uses quick change ferruled sieves with 20 in. diameter sifting area. There are no loose wires to harm hands.

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- SPEED
- ECONOMY
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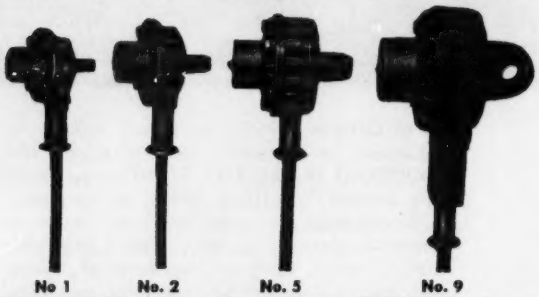
Its sturdy one-piece frame and long shaft add to vibration effectiveness. The sealed-in mechanism assures protection of motor and bearings from exposure to dust and grit. This sealed in protection and "Rotoplane's" free-rotary action vastly increase bearing life. No exposed moving parts endanger the operator. Sieves have 20 inches diameter clear sifting area—are mounted in a smooth steel ferrule with no jagged edges to cause dangerous cuts and scratches.

"RED (Devil) ELECTRIC" VIBRATORS



No 1 No. 2 No. 5 No. 9

These hard hitting Adams designed Vibrators have served the foundries for over 30 years. They are provided with a 6 foot 3 wire authorized cable and 3 wire grounded connector which, when connected with our 3 wire grounded Red Electric Knee Switch, automatically grounds the vibrator protecting the worker from shock. The vibrators have passed the U. S. Government code inspection.

Other Foundry Products:

- No. 11 NOISELESS TYPE VIBRATOR
- A-20 ELECTRIC VIBRATOR
- RED ELECTRIC KNEE SWITCHES
- "ROTO" ADJUSTABLE BIN VIBRATOR
- 2 MIN. UNIVERSAL FINENESS TEST SIFTER.
- UNIVERSAL TRIPOD CARRIER

ORDER ALL SIFTERS AND VIBRATORS WITH GROUND WIRE!!

FOUNDRY SUPPLIES MANUFACTURING CO., NOT INC.

2221 Orchard Street Chicago 14, Illinois

Established 1918 Cable Address: "Rotoplane Chicago" H. V. ADAMS, Mgr.

Circle 585 on Page 53

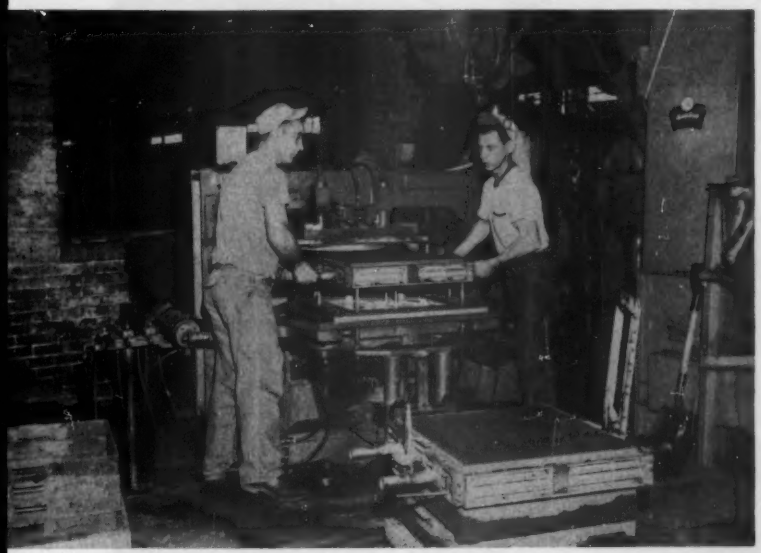
Circle 586 on Page 53→

ANOTHER

NEW INTERNATIONAL

SK20

Jolt-Squeeze-Drop Strip or Pin Push Up *or* Drop Strip Roll On – Roll Off



Photos Courtesy of
PHILCO CORPORATION - Dexter Foundry Division - Fairfield, Iowa

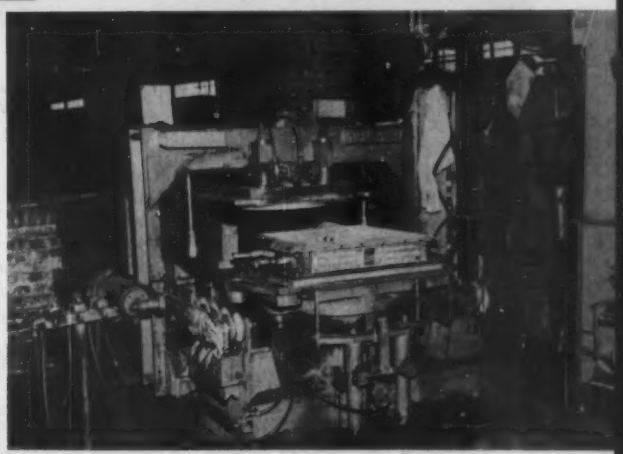
Here is a new machine, designed for larger requirements, incorporating sound engineering features, that can be made with

any size jolt
any size squeeze
any size draw
for any size job.

The SK20 illustrated has 20″ squeeze cylinders, an 8″ jolt cylinder, and is designed as a multiple molding machine—with a 4″ draw. Picture shows hand control valves. It can also be furnished with partial or completely automatic control cycle.

Operational Features of the SK20

- ★ Head moves out – away from table of machine for easy loading of sand and flask.
- ★ Head moves in – Large V guides insure proper alignment of head over table for accurate and square, uniform squeeze – and true draw.
- ★ Two large cylinders control the movement of the head with oversized deceleration valves for cushioning.
- ★ Can be loaded from front – side – or rear.



The INTERNATIONAL LINE is designed by experienced foundry engineers who have a practical working knowledge of the problems of the industry.

Write, telling us your particular needs.
We will forward complete information and suggestions.

by INTERNATIONAL
MOLDING MACHINE COMPANY
LAGRANGE PARK, ILLINOIS

Keep high alloy melts CLEAN

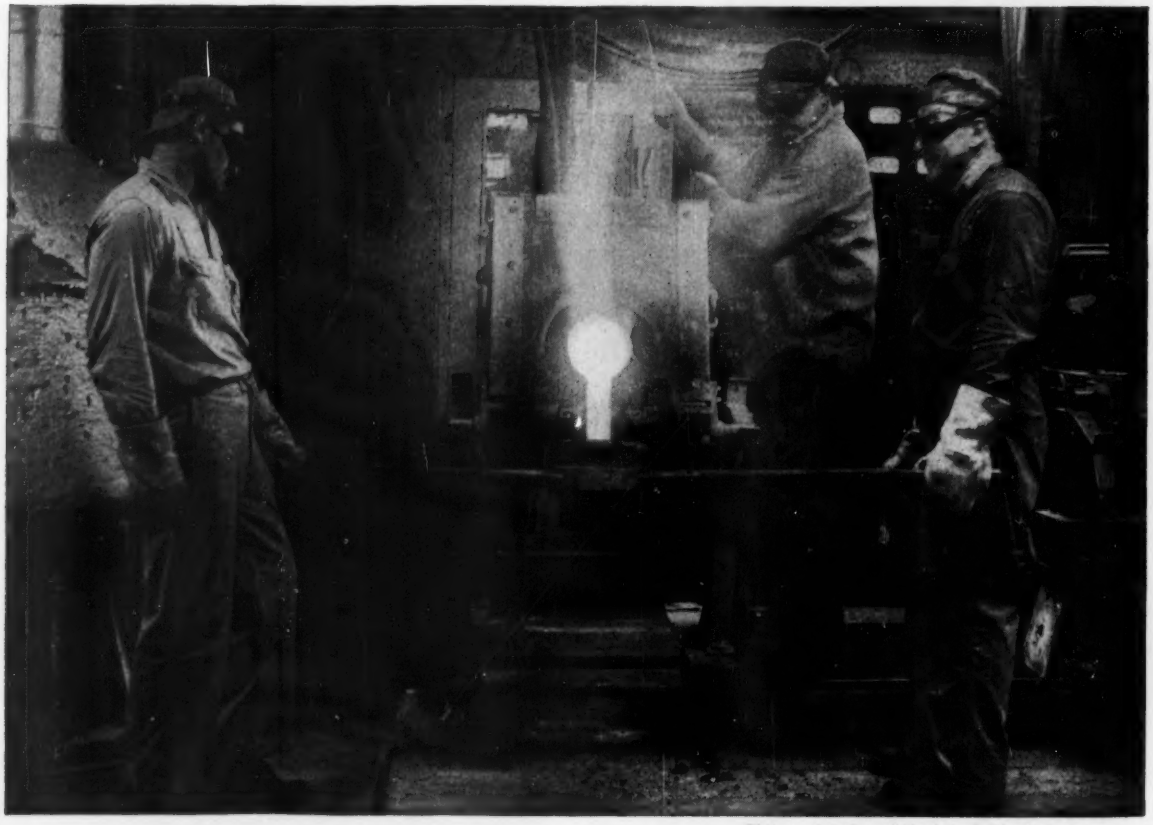


Photo courtesy Arwood Precision Casting Corporation.

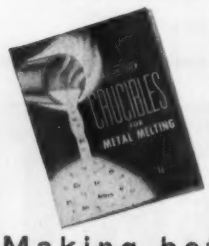
. . . with Norton Crucibles

You can pick the exact type of crucible you need for precision casting of high alloy steels from the wide NORTON line and have excellent protection against contamination.

No other crucibles give you such high stability to both heat and chemical action under a wide range of operating conditions. What's more, their fine, smooth surfaces are invaluable wherever molten metal must be kept free of refractory inclusions.

Specifically engineered for use in induction-type and indirect arc furnaces, these rugged NORTON Crucibles are ideal aids to critical casting techniques where both high precision and purity of the molded part are essential.

NORTON Crucibles can increase the precision, efficiency and economy of your casting operations. They're available in a wide variety of sizes. Get full details from your NORTON representative. And write for this new informative catalog on the *complete* line of NORTON Crucibles. NORTON COMPANY, Refractories Division, 300 New Bond Street, Worcester 6, Massachusetts.



*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

MAGNORITE* K Crucibles (97% Fused Magnesia)
Widely used for melting steels and ferrous alloys as well as cobalt, chrome, copper, bronzes and nickel.

MAGNORITE M Crucibles (99% Fused Magnesia)
Designed to meet refractory requirements calling for low boron, iron oxide, and silica content.

ALUNDUM* A Crucibles (99% Alumina)
Provide outstanding stability in both oxidizing and reducing atmospheres. Ideal for vacuum melting.

ZIRCONIA H Crucibles (Fused Stabilized Zirconia)
For operations where extremely high refractoriness and low thermal conductivity are required.

CRYSTOLON* Silicon Carbide Crucibles and other types of crucibles also available for melting nonferrous metals and alloys.

NORTON
REFRACTORIES
Engineered... Rx ...Prescribed

Making better products . . . to make your products better

NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — BEHR-MANNING DIVISION Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

All these PROTECTIVE features are a part of the H-25 PAYLOADER®

"The more than 10,000 small 'PAYLOADER' tractor-shovels that we have produced for steel mills, foundries, chemical and fertilizer plants usually operate under exposure to dust, dirt, powder and foreign materials," says Ralph Beyerstedt, Executive Vice-President of The Frank G. Hough Co.

"During the development of the H-25, as soon as it became evident that we were going to obtain the increased capacity, production, operating ease, speed and mobility we sought, our engineers then gave major attention to *protective features* for operational insurance against wear, maintenance delays, abuse, downtime and the like."

Dozens of Protective Features

"We started by giving the engine maximum protection with a triple air cleaning system, cartridge-type oil filter, sealed ignition and starter switches, a 12-volt electric system with sealed generator, solder coated terminals and a clutch-pressure warning device. The filtered hydraulic system is closed and pressure controlled and the majority of all major pivot points in the boom arm mechanism, the gearshift and steering linkage are sealed."

What About H-25 Production?

"Most important of all, the operating capacity of the H-25 is 2,500 lbs.—25% greater than has ever before been available in a tractor-shovel of its size and maneuverability. It is the only loader in its size range with *complete* powershift transmission—having 2 speed ranges forward and 2 in reverse. Power steering also is standard.

"Other plus features of the H-25 that mean more production, long life and less maintenance are the exclusive power-transfer differential, wet-sleeve overhead valve engine, 4,500 lbs. of bucket breakout force and 40° bucket tip back at ground level."

Your "PAYLOADER" Distributor wants to show you how the greater capacity, easier handling and more fully protected H-25 can cut your bulk handling costs.

HOUGH®

THE FRANK G. HOUGH CO.
LIBERTYVILLE, ILLINOIS
SUBSIDIARY — INTERNATIONAL HARVESTER COMPANY

HOUGH, PAYLOADER, PAYMOVER, PAYLOGGER and PAY are registered trademark names of The Frank G. Hough Co., Libertyville, Illinois

THE FRANK G. HOUGH CO.
703 Sunnyside Ave., Libertyville, Ill. F

Send H-25 "PAYLOADER" data.

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Title _____

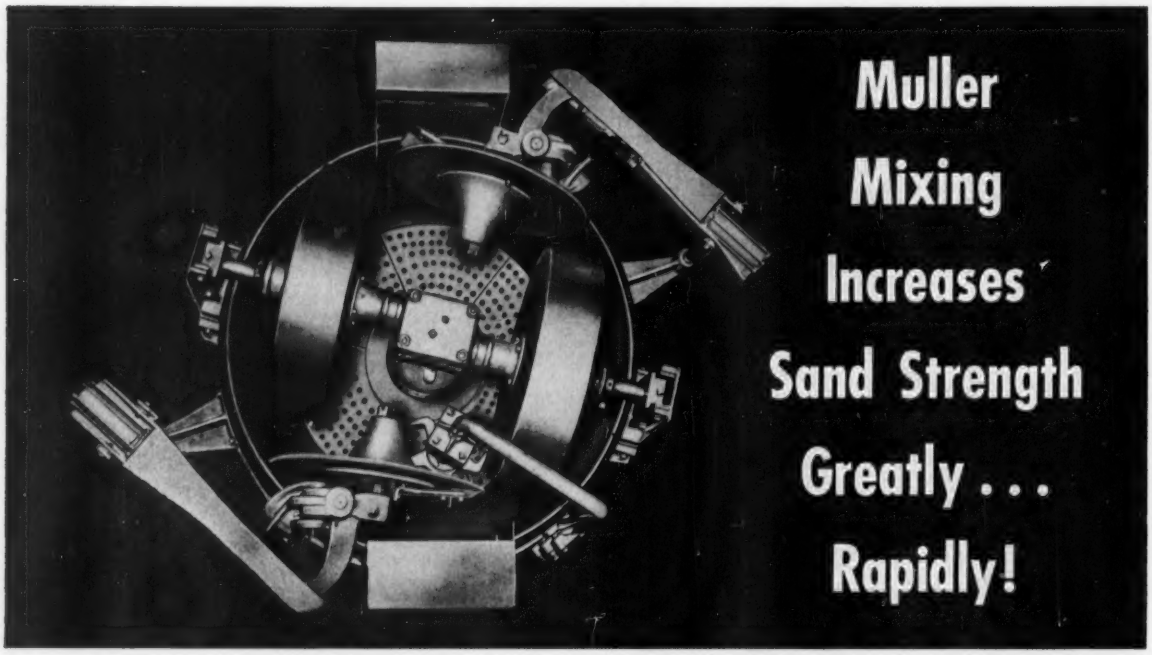
Company _____

Street _____

City _____ State _____

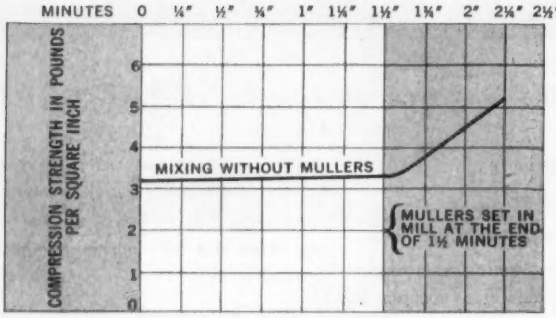
1-A-1

Circle 588 on Page 53



Muller Mixing Increases Sand Strength Greatly . . . Rapidly!

Sand Strength Curve Proves the Difference



This Strength Curve Chart demonstrates how much more effective muller mixing of sand is over regular scraper type mixing. In this test a Clearfield mixer was used to mix a charge of 91% burned sand, 3% bond and 6% water. At the start of the run the mulling wheels were removed completely . . . the batch was charged and the mixing operation continued for 1½ minutes with only the disc and agitator operating on the material. *There was only a slight increase in the strength of the sand.* Then the mullers were set into the machine and operation on the same batch continued for 1¼ minutes. During this very short period with the mullers operating, *the sand strength increased very rapidly.* You can speed production, with assured quality results—and cut costs too—with a Clearfield muller-type mixer. *Let us prove the superiority of Clearfield Muller-type Mixers with a sample run of your own batch. Just call us.*

WITH its speed, dependability and special mixing features, a Clearfield Mixer prepares your sand properly and exactly as you want it . . . thus paying for itself many times over. In addition to the strength-building mullers, Clearfield Mixers have other features that assure quality results every time. First, all Clearfield Mixers work on the rotating pan principle so that every particle in the batch is kept in continuous motion, with the ingredients alternately spread and gathered together to maintain highest mixing efficiency.

Another feature is the patented star-shaped agitator which covers the entire flat surface of the revolving bottom and prevents material from forming hard cakes or lumps. The agitator is driven automatically by the force of the sand being rotated by the pan motion; a "whirlpool" action is created, speeding up the mixing process and promoting clean emptying of the pan.

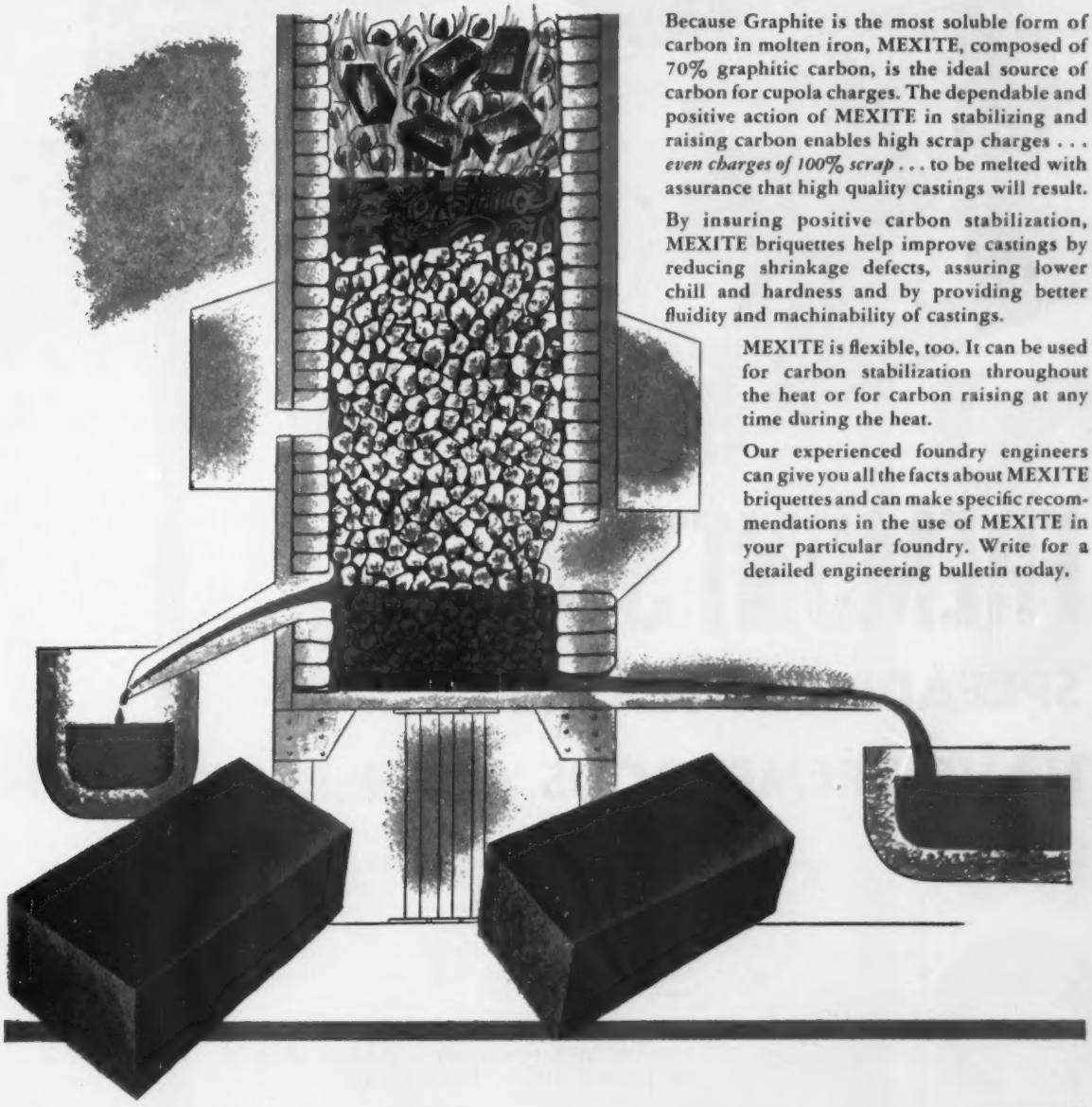
The Clearfield double-duty disc, also patented, cuts all the material free from the revolving pan rim at each revolution, turns it over and diverts a continuous roll of material under the mullers. (Moved to the discharge position, this disc unloads the complete batch in 15 to 20 seconds!)

You get thorough, proper blending and mixing when you use a Clearfield Mixer.

for complete details about the wide variety of Clearfield Mixers, write for Catalog No. 90

CLEARFIELD
MACHINE COMPANY
CLEARFIELD, PENNSYLVANIA, U.S.A.

YOU CAN CHARGE MORE SCRAP IRON AND GET HIGH QUALITY CASTINGS WITH MEXITE® (GRAPHITE BRIQUETTE)



Because Graphite is the most soluble form of carbon in molten iron, MEXITE, composed of 70% graphitic carbon, is the ideal source of carbon for cupola charges. The dependable and positive action of MEXITE in stabilizing and raising carbon enables high scrap charges . . . *even charges of 100% scrap* . . . to be melted with assurance that high quality castings will result.

By insuring positive carbon stabilization, MEXITE briquettes help improve castings by reducing shrinkage defects, assuring lower chill and hardness and by providing better fluidity and machinability of castings.

MEXITE is flexible, too. It can be used for carbon stabilization throughout the heat or for carbon raising at any time during the heat.

Our experienced foundry engineers can give you all the facts about MEXITE briquettes and can make specific recommendations in the use of MEXITE in your particular foundry. Write for a detailed engineering bulletin today.

262

THE UNITED STATES GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW 14, MICHIGAN

GRAPHITAR® CARBON-GRAPHITE • GRAMIX® POWDER METALLURGY • MEXICAN® GRAPHITE PRODUCTS • USG® BRUSHES

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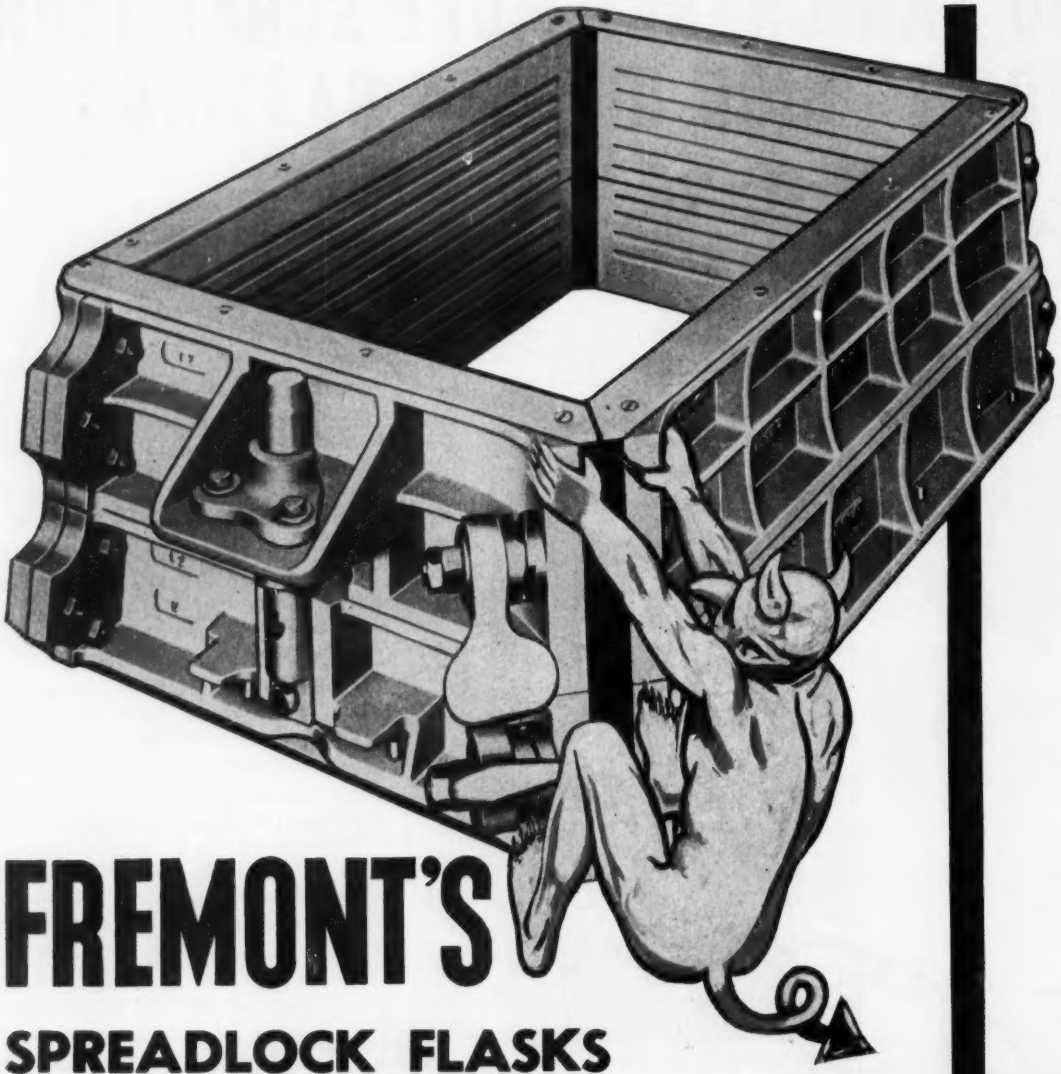

FREMONT'S

SPREADLOCK FLASKS

HAVE TREMENDOUS CORNER STRENGTH

The flask itself is made of magnesium. This gives it strength and lightness. Cams are hardened steel forgings; this assures extra strength where it is needed. Locks, pins and cams are accurately machined; this provides a flask that can be used over and over again for exacting work.

The new FREMONT FLECKS-O JACKET has been developed particularly to eliminate shifts and runouts. Ask us about prices and delivery.

The Fremont Flask Co., Fremont, O.

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Circle 592 on Page 53→

Sharper casting detail with FEDERATED phosphor copper. When you add phosphor copper to reduce porosity, increase castability, and assure sharper detail, guarantee yourself finest performance with Federated quality material. Like the famous Federated line of aluminum and copper base alloys, phosphor copper is produced under the strictest metallurgical controls in the industry. It is stocked as shot or waffle in a nation-wide network of warehouses for immediate shipment. Federated Metals Division of American Smelting and Refining Company, 120 Broadway, New York 5, N. Y. In Canada, Federated Metals Canada, Ltd., Toronto and Montreal.

FEDERATED METALS DIVISION OF

ASARCO

AMERICAN SMELTING AND REFINING COMPANY

Minerals International Chemicals

A REPORT TO FOUNDRIES

FROM TOM BARLOW

Prophet Prophesies Profits

FLASH — Well-founded foundries find fine finished founding won't flounder or founder in founder's foundry.

The above is my prediction for 1960. Everyone likes to be a prophet — especially if he can profitably prophesy profits. Before examining the prediction in detail, did you ever ponder on the peculiar meanings of the word "founder"? It appears three times in Webster's Collegiate Dictionary.

Founder — One who founds or establishes.

Founder — One who founds or casts metals.

Founder — To fall helplessly; to stumble. To fail; miscarry. To dismay; dumfound.

What a pessimistic combination of definitions. No wonder many a founder who founders a foundry founders. (I'm getting dizzy.)

So for predictions for 1960, I believe that:

Foundries founding saleable castings will sell more.

Foundries which control the *completed* cost of a finished saleable casting will make money.

Foundries which cut *departmental* costs without regard for casting saleability will lose money.

Foundries which buy on price alone will get cheated.

Foundries which sell on price alone will founder — or at least flounder.

Foundries which think in terms of customer benefits will benefit themselves.

Foundries in which all supervisory and management people base their decisions on the saleability of their product will prosper.

In all walks of life, we read of the fabulous 60's. An era when our population will grow so fast that we will get rich. These times, however, will provide a greater challenge than any single decade in the past because it will be a decade of progress. I remember similar predictions at the turn of the century (well — I can at least remember hearing about them). The new century was going to bring prosperity and progress such as never seen before. It did, too. Automobiles, radios, airplanes, etc., etc. Such lush times — except for the manufacturers of buggy whips, the village blacksmith, and the men who said "it will never fly."

Am I being too general? Okay. Let's be specific. In too many foundries, we see a lack of sales awareness. The sand foreman has to keep his sand costs down. The molding foreman keeps his molding costs down. The melting foreman keeps his melting costs down. These are all necessary. But too often such short-term objectives may actually interfere with the cost of the finished, "sold" casting. A casting is no good until it is sold — and at a profit.

To illustrate — suppose the sand man cuts his sand costs to the bone. Flowability is low, the castings come rough and penetrated. (Scrap may go up — but that's such an obvious expense we'll skip it in this case history.) At the same time, the molding foreman puts his jobs on undersized equipment, cuts the jolts or the ramming to save time, uses burnt bottom boards, poor flasks and worn pins, etc. His short-term costs are down. Likewise, the core room can cut costs (I won't go into detail because this space costs money, too). As a result of all these the cleaning room has high costs, or they, too, can cut corners, in which case you really have a problem.

Now the casting is ready to ship — it may be rough and overweight, or even just a little bit shifted — but it's a casting. Where then is the cost? *It's in selling!* It will require money to sell this casting — unnecessary out-of-pocket selling expense. And often even this extra expense fails to avoid lost sales. Low tonnage costs money, lost sales mean low tonnage. Or if we wish to follow this obviously exaggerated example to its awful conclusion — we cut the price. With a cut price and lost business, profits go down — so where is our "economy" program now?

To say all this another way — the men who make the castings are a most important part of the sales team. Their job is to make *profitable* sales. Let's face facts. Profit is not cost — it's the *difference* between cost and selling price. This difference is a function of quality — vive le difference!

An old Indian proverb says, "Lie to a liar because lying is his coin. Steal from a thief, for that is easy. But beware of the man who has no axe to grind." Rather than be accused of having no axe to grind, I'll spell ours out. We sell to foundries, so we want foundries to prosper. More immediately, however, most of our products are designed for the production of quality castings. We do our best with the foundry who wants the sand to produce quality castings. We are proud of the castings produced in PLASTIBOND, TRIPLACT and other additives. We like to see the results of proper use of DIXIE BOND, BLACK HILLS and REVIVO. We would like to help you make better castings at a profit. We believe that, like foundries, foundry suppliers who think in terms of customer benefits will benefit. May we help you (and thereby help ourselves)?

Products for Growth®

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EASTERN CLAY PRODUCTS DEPT.

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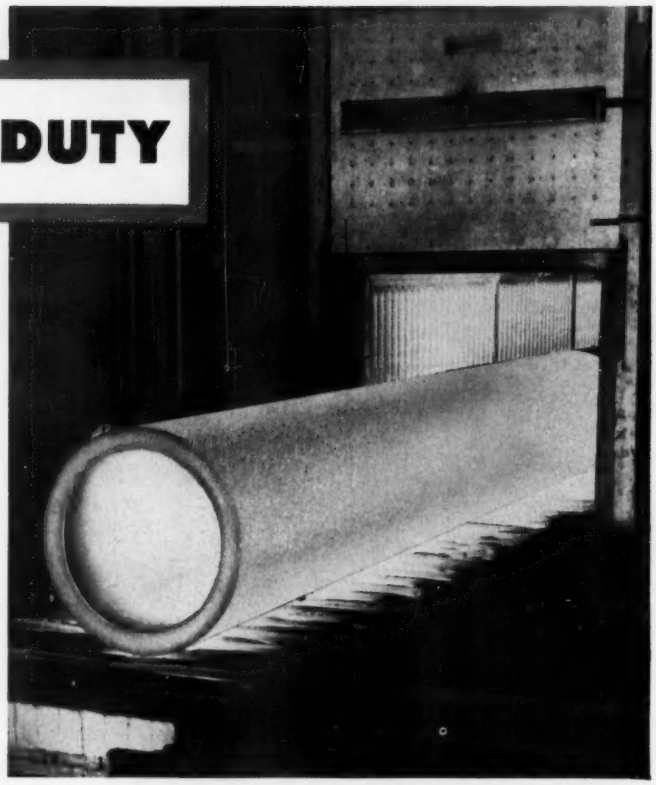
Circle 593 on Page 53

Ask HEVI-DUTY

Sandusky Foundry and Machine Company did...

and now heat treats centrifugal castings of carbon and alloy steel at controlled, uniform temperatures up to 2050° F. with a



Sandusky Foundry and Machine Co. selected this Hevi-Duty Electric Car Bottom Furnace, rated at 2050° F. for their heat treating requirements. Casting being heat treated here weighs 13,700 lbs.

HEVI-DUTY CAR BOTTOM FURNACE

When your heat treating applications demand *quality production at uniform controlled temperatures*, Hevi-Duty can supply either electric or fuel-fired furnaces to meet your requirements.

For example: At Sandusky Foundry and Machine Co., Sandusky, Ohio, centrifugal steel castings up to 50 inches in diameter by 33 feet in length have been heat treated in a Hevi-Duty Electric Car Bottom Furnace. This furnace provides accurately controlled temperatures to 2050° F. in its 6′ x 6′ x 34′ long chamber. They use it to normalize, temper and anneal steel and stainless steel castings. Parts are either air cooled or water quenched.

The Hevi-Duty Car Bottom Furnace features five zones of temperature control, and by placing a dividing wall between the three forward and two rear zones, two separate loads with different temperature ranges can be treated simultaneously. Heating elements in side and end walls, ceiling, door and car bottom, plus three removable air-circulating fans help provide uniformity of temperature.

Whatever your particular heat treating application, there's a Hevi-Duty furnace designed to do the job. Car Bottom Furnaces are available with many arrangements and optional features—single or double end, retort type, controlled atmosphere, forced-air convection and others. Be sure to contact Hevi-Duty first for your heat processing equipment needs.

HEVI-DUTY

A DIVISION OF BPC BASIC PRODUCTS CORPORATION

ASK HEVI-DUTY

for more information on electric or fuel-fired heat treating furnaces. Car Bottom Furnaces are fully described in Bulletin 644R.

HEVI-DUTY ELECTRIC COMPANY, MILWAUKEE 1, WISCONSIN

Industrial Furnaces and Ovens, Electric and Fuel • Laboratory Furnaces • Dry Type Transformers • Constant Current Regulators

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Use These Cards . . .

FOUNDRY

- For more information on anything advertised in this issue
- For further data on products described in the Equipment and Supplies section (Page 99)
- To get copies of publications listed in the Literature for Foundrymen section (Page 170)
- To request extra copies of editorial articles

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404	434	464	494	524	554	584	614	644	674	704	734	764	794	824	854
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408	438	468	498	528	558	588	618	648	678	708	738	768	798	828	858
409	439	469	499	529	559	589	619	649	679	709	739	769	799	829	859
410	440	470	500	530	560	590	620	650	680	710	740	770	800	830	860
411	441	471	501	531	561	591	621	651	681	711	741	771	801	831	861
412	442	472	502	532	562	592	622	652	682	712	742	772	802	832	862
413	443	473	503	533	563	593	623	653	683	713	743	773	803	833	863
414	444	474	504	534	564	594	624	654	684	714	744	774	804	834	864
415	445	475	505	535	565	595	625	655	685	715	745	775	805	835	865
416	446	476	506	536	566	596	626	656	686	716	746	776	806	836	866
417	447	477	507	537	567	597	627	657	687	717	747	777	807	837	867
418	448	478	508	538	568	598	628	658	688	718	748	778	808	838	868
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420	450	480	510	540	570	600	630	660	690	720	750	780	810	840	870
421	451	481	511	541	571	601	631	661	691	721	751	781	811	841	871
422	452	482	512	542	572	602	632	662	692	722	752	782	812	842	872
423	453	483	513	543	573	603	633	663	693	723	753	783	813	843	873
424	454	484	514	544	574	604	634	664	694	724	754	784	814	844	874
425	455	485	515	545	575	605	635	665	695	725	755	785	815	845	875
426	456	486	516	546	576	606	636	666	696	726	756	786	816	846	876
427	457	487	517	547	577	607	637	667	697	727	757	787	817	847	877
428	458	488	518	548	578	608	638	668	698	728	758	788	818	848	878
429	459	489	519	549	579	609	639	669	699	729	759	789	819	849	879
430	460	490	520	550	580	610	640	670	700	730	760	790	820	850	880

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FOUNDRY

Reader Information Service

Just mail one of these cards . . . for more information on anything advertised in this issue . . . for further data on products described in the Equipment and Supplies section (Page 99) . . . to get copies of publications listed in the Literature for Foundrymen section (Page 170) . . . to request extra copies of editorial articles.

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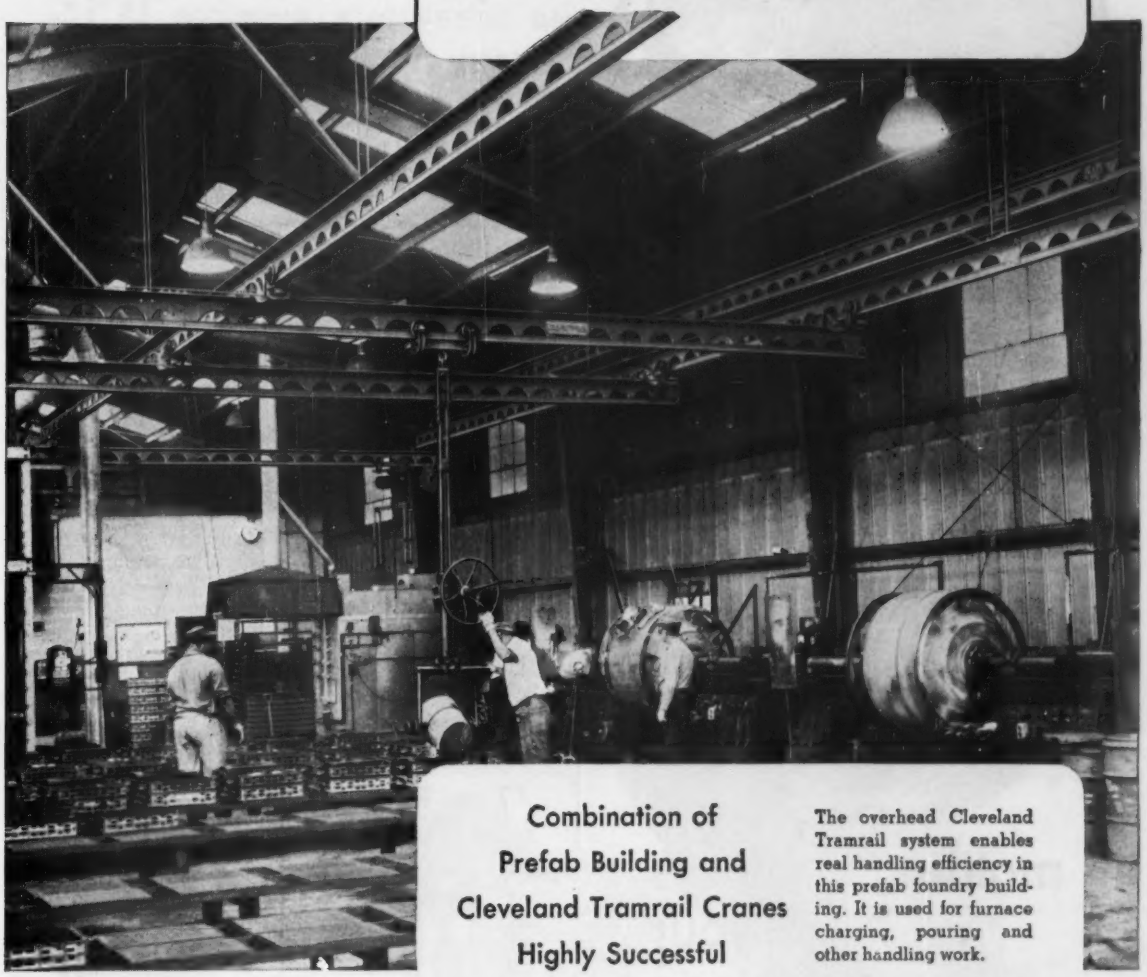
Here's an idea for a **LOW COST EFFICIENT FOUNDRY**



Combination of Prefab Building and Cleveland Tramrail Cranes Highly Successful

The overhead Cleveland Tramrail system enables real handling efficiency in this prefab foundry building. It is used for furnace charging, pouring and other handling work.

THE foundry of Western Automatic Machine Screw Co., Elyria, Ohio, offers a real idea for saving money to anyone contemplating expanding or building a new foundry.

Two prefabricated metal buildings, each 50' x 160', joined side by side, are used for the structure. Although the building trusses will support concentrated loads of 6000 lbs. at the middle of the span, the Cleveland Tramrail cranes are of one ton capacity and operate on three runways. There also is Tramrail trackage over the 750 lb. gray iron electric furnaces on which motorized carriers handle buckets of charge materials.

This foundry has proven very successful, both from standpoints of original cost and production efficiency. Cleveland Tramrail's "know-how" in equipping prefab buildings with materials handling equipment has proven of great help in achieving these ends. Of importance, too, is Cleveland Tramrail's method of flexible track suspension which minimizes load concentrations and provides better distribution of stresses.

Western Automatic's foundry, including concrete work, sewer, plumbing, lighting and the Cleveland Tramrail equipment cost far less than for a conventional building, yet it produces efficiently.

As a leader in foundry materials handling equipment, look to Cleveland Tramrail for cost-saving ideas.

FREE BOOKLET: *If you have a prefab or are considering erecting one, this illustrated booklet will be helpful.*
Write for No. 2020A

CLEVELAND TRAMRAIL
Overhead Materials Handling Equipment

CLEVELAND TRAMRAIL DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 3840 E. 286 ST. • WICKLIFFE, OHIO

Circle 595 on Page 53

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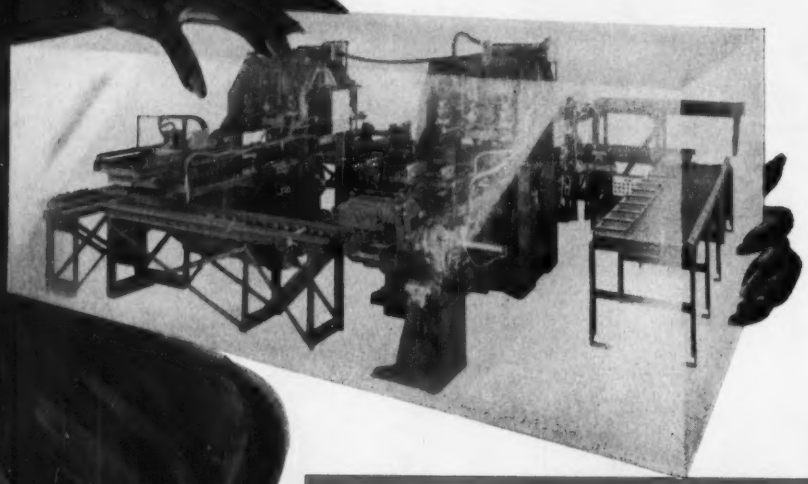
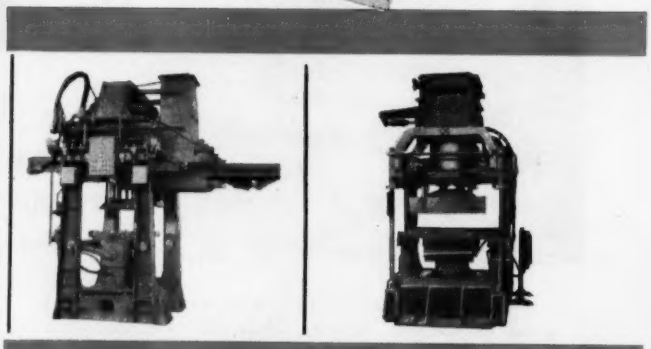


packaged
molding systems
to your
specifications



SPO DESIGNS, ENGINEERS AND PRODUCES VERSATILE "CUSTOM" CAPABILITIES FROM STANDARDIZED MACHINES AND COMPONENTS

In today's fast-paced competitive foundry market, the molding equipment with the greatest inherent versatility will pay the highest long-term dividends in performance and profits. This fact-of-life applies to repetitive high-production foundries as well as jobbing operations.

DO YOU REALLY NEED SPECIAL MACHINES?

The recent advent of *limited function molding machines* . . . such as those without a jolt cycle . . . raises the question of the economic feasibility of special-purpose machines in molding systems. Some molds do not require jolting. And foundries specializing in this type of mold can use joltless designs effectively.

But . . . the real problem with limited function machines lies in a foundry's *long-range needs.* If both jolted and non-jolted molds must be made in the same facility, it would seem the foundry theoretically could utilize both types of molding machines. This condition, however, would require an *unnecessary increase in capital investment without a compensating increase in versatility!* SPO has solved this problem by a new and advanced squeeze head design.

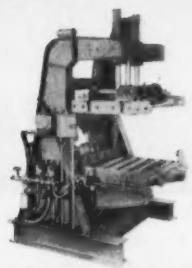
SPO OFFERS MULTI-FUNCTION STANDARD DESIGNS

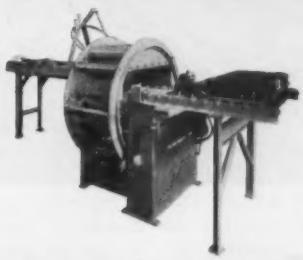
To eliminate duplication of equipment, SPO has developed a *new Compensating Squeeze Head design that permits the jolt cycle to be locked out when not required,* but has it available as soon as jolting is needed. In one standard machine, for one initial investment, SPO provides the versatility to produce every type of mold. This practical approach typifies SPOMAGIC . . . creative engineering for efficient low-cost foundry molding operations.

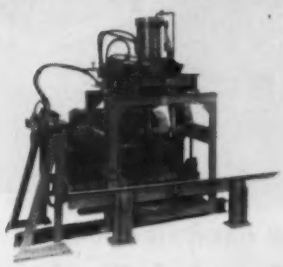
PACKAGED SYSTEMS FROM PRE-ENGINEERED UNITS

This same design and methods awareness is utilized in SPO-engineered molding systems. Using standardized machines and auxiliary equipment, SPO can develop "packaged" systems to meet every specific requirement. And, if necessary, SPO can design, engineer and fabricate special ancillary equipment to support the basic system. As the world's largest supplier of molding machines, SPO also is the best qualified to help you analyze and solve your molding problems. No other company can show you as many "tailored" automatic systems in operation today . . . or offer you broader experience in molding methods.

WRITE OR CALL FOR ADDITIONAL INFORMATION.







WORLD'S LARGEST SUPPLIERS SPO OF MOLDING MACHINES

ONLY SPO OFFERS THIS RANGE OF AUTOMATED SYSTEMS COMPONENTS AND SERVICES

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3. Automatic Cope Closers
4. Automatic Weight Setters
5. Automatic Flask Separators
6. Automatic Jolt-Shake Outs
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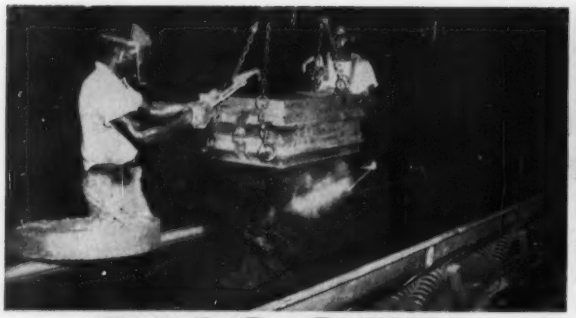
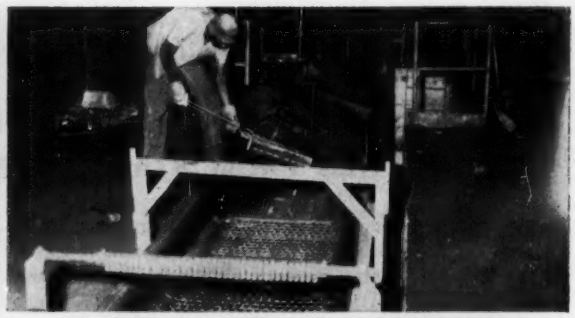
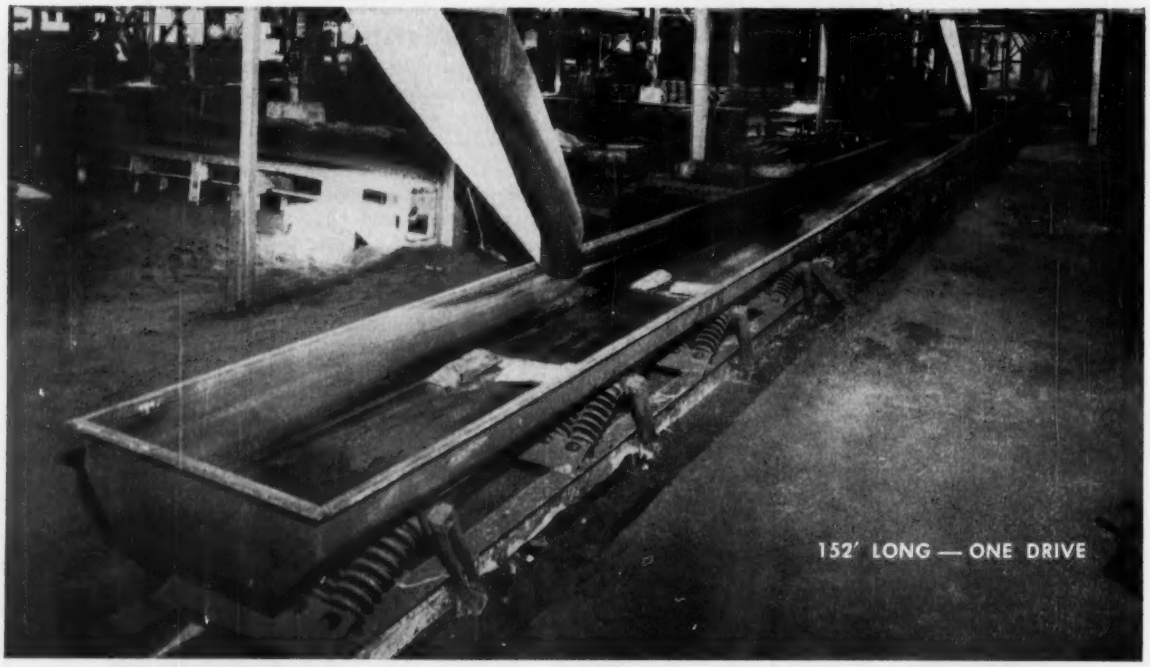




RUGGED ▶ VERSATILE

Impact of hot sand, castings no problem.

Built-in shakeout with lump-breaker separates sand and castings.



IN NASHVILLE FOUNDRY:

Special Shakeout-Conveyor lowers handling costs

This Carrier Natural-Frequency shakeout conveyor—152-feet long with a single 30 H.P. drive—has been installed in the foundry at Phillips & Buttorff Manufacturing Co., Nashville, Tenn., to replace a system of hand shakeouts and belt conveying.

Result: The new Carrier Conveyor has greatly reduced labor costs, equipment downtime and sand spillage. It produces cleaner castings, requires less manpower and generally provides a more efficient operation than was previously possible.

Once the requirements were outlined by Phillips & Buttorff's engineering department, Carrier custom-designed this conveyor to improve the system for handling sand and castings. The conveyor's simple, rugged construction plus a special built-in shakeout section are perfect examples of Carrier's versatile engineering service.

CARRIER

NATURAL-FREQUENCY VIBRATING EQUIPMENT

Engineering Specialists in Vibrating Equipment

Write for Foundry Equipment Bulletin: Carrier Conveyor Corporation, 226-A North Jackson Street, Louisville 2, Kentucky

Readers' Comment

Seeks Shell Molding Unit

To THE EDITORS:

We would like to acquire a small shell molding unit with electrical heating, and facilities for adding a dumpbox. It will be used for instructional purposes, including student use and demonstrations. We will appreciate any help in placing us in contact with some firm which might have molding equipment suitable for this purpose, and which might be willing to donate it or sell it at a nominal price for educational purposes.

JOHN C. BIERLEIN
Instructor
University of Wisconsin
Madison, Wis.

Editor's note: We suggest that anyone interested in helping this project get in touch directly with Mr. Bierlein.

Sound Castings Can Be Made

To THE EDITOR:

Your editorial in the September issue is very interesting. I could and should have written you a similar letter, and need such information.

Individual foundry organizations are in several classes. Very few seem to wish to take advantage of our desire for sound castings. It is true that we specify castings with properties approaching forgings. Anyone in this field knows that these castings can be made, but few are willing to do this job.

Mr. Sanders' remarks on castings and customers (September, Page 166) covers these ideas rather thoroughly.

L. P. WILSON—1621-1
Casting Co-ordinator
Sandia Corp.
Sandia Base
Albuquerque, N. M.

Meetings with the Japanese

To THE EDITORS:

This letter is to express our appreciation for your generous co-operation in receiving the group of Japanese nationals who were in the United States recently under Project No. 88-80-114—Small Business Copper Alloy Foundry Study.

In Washington, and just prior to returning to Japan, they commented enthusiastically on the constructive visit with your organization, and you can be sure it contributed substantially to the success of the project.

JOHN H. BRONG,
Project Manager
International Co-Operation Admisistration
Washington 25, D. C.

The editors of FOUNDRY are happy to have been hosts to this group of Japanese brass and bronze founders. Others which have visited with the editors recently include teams of Japanese gray iron and malleable founders.

Compare Comparable Products

To THE EDITORS:

Steel Facts, issue No. 157 for October, 1959, has just come across my desk, and on page 4 I find some statistics which I believe to be important. According to the figures presented by the American Iron and Steel Institute, shipments of steel mill products for 1958 were 59,900,000 tons.

Such statistics, rather than tons of steel ingots produced, should be compared with the quantity of castings shipped (13,178,880 tons in 1958). Comparing the quantity of castings shipped with the tons of ingots produced does not present a true picture of the size and importance of the foundry industry.

Those who attempt to publicize the foundry industry should compare shipments of castings with those of rolled steel products, not with steel ingot production, whenever such comparisons are necessary.

Ingot steel production is a good indication of amount of steel melted during any period. To obtain the tons of foundry alloys melted during a similar period would be very difficult, but it would be a sizable quantity.

My plea is that if we must compare ourselves with the wrought steel producers, let us do it on a comparable basis.

DOUGLAS C. WILLIAMS
Associate Professor
Department of Metallurgical Engineering
The Ohio State University
Columbus, Ohio

SEE NEXT PAGE

with the *Exclusive*

fine FANNER FAN-S-CHILLS

provide superior chilling and greater savings

A triumph of modern research and engineering — the FAN-S-CHILL, through its curved "S" design, provides 75% more chilling surface since there is no solid mass.

Exclusive design with its perforated surface and double channel permits maximum parent metal fill-in . . . fuses into cast metal solidly, completely . . assures better quality castings.

Formed steel fabrication provides highest possible chilling efficiency . . . ideal for general chilling purposes . . . especially in steel.

Lightweight construction provides triple savings — in cost, in shipping and in handling.

Get the facts on the many cost saving features of the fine FANNER FAN-S-CHILL . . . write today for samples and latest prices.

SPECIFICATIONS:

WIDTH: ⅜" — ⅝" — ¾" — 1" — 1¼"

LENGTH: ½" to 5"

Made in heavy, medium and light gauges.

Copper, aluminum or tin coated.

Lighter or heavier? FAN-S-CHILLS in special sizes can be made on request.

ENGINEERING SERVICE:

Qualified and specialized engineers in Fanner's Technical Service Division are available for consultation, without obligation, on problems of producing more intricate castings; developing increased strength, closer tolerances, and better quality; reducing machining and improving finish — both in ferrous and non-ferrous castings. Take advantage of the research and development work that Fanner has invested in this field to improve your profit picture! Simply direct your request to the address shown below.

THE FANNER MANUFACTURING CO.

Designers and Manufacturers of FINE FANNER CHAPLETS AND CHILLS

BROOKSIDE PARK CLEVELAND 9, OHIO

CURVED "S" DESIGN

LIGHTWEIGHT

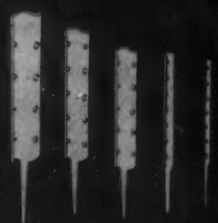
Savings in cost. Lower shipping charges. Easier to handle on the job.

GREATER FUSION

No pockets to trap gases. Perforations permit metal flow-through. So completely fused, difficult to detect even with X-ray.

GREATER CHILLING SURFACE

75% greater chilling area since there is no solid mass — produces better castings.



5 STANDARD SIZES

The ideal chill for a wide range of applications. A size for every need — eliminates makeshift chilling.

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Eight strategically located Sterling branch offices, backed by **eighty** well-known foundry supply houses, assure fast and efficient flask service. To achieve this greater service, we have added to, and relocated, our regional sales staff. These Sterling factory-trained flask specialists are now serving the foundry industry:

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141 Milk St., Boston 9, Mass.

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The next time you need foundry equipment we suggest you contact the Sterling representative nearest you.

Sterling
WORLD WIDE SERVICE

STERLING NATIONAL INDUSTRIES, INC.
Founded 1904 as Sterling Wheelbarrow Co.
Milwaukee 14, Wisconsin, U. S. A.
Manufacturers of Foundry Equipment for More than Half a Century

It Looks Good

Castings shipments will increase 10 per cent in 1960 over 1959. This is the prediction of a representative cross section of foundrymen in a study conducted by FOUNDRY.

This belief in business growth may result from the emphasis foundry trade associations are placing on the marketing of castings. It may be influenced by the extraordinarily successful business publication promotion campaign being carried on by the Malleable Castings Council. It may result from a realization that technical and mechanical progress is opening new fields for the application of quality castings. Or it could be that a new generation of foundrymen, not discouraged by bitter experiences of the past, are looking to the challenge of the future with greater confidence.

Many other reasons may have contributed to this general change of attitude, but whatever the cause, the fact remains that foundrymen appear more optimistic. For the second year in a row, they have reported better business prospects. Last year their prediction (February, 1959, p. 101) proved extremely accurate. Without a steel strike that was not apparent at the time of that poll, 1959 production of castings would have exceeded the industry's forecast by a substantial amount.

The 1960 forecast likewise may prove to be conservative. Data for the study were collected before the steel strike injunction was in effect, and the result undoubtedly was colored by that uncertainty.

In comments accompanying the questionnaires, a number of those participating in the study suggested that if industrial peace can come in steel, and crippling strikes can be avoided in other basic industries, 1960 may be one of the best years in the history of the foundry industry.

So turn the page and read this report of confidence.

And rejoice that foundrymen are expressing confidence in the future of the industry and are backing that enthusiasm with plans for new plants or modernization programs.

It looks like a Happy New Year.

Frank G. Steinebach
Editor

Foundrymen Predict

10% UPTURN IN 1960

Better demand for castings in 1960 is anticipated by 65 per cent of all foundries; 30 per cent see little change from 1959. Extensive program of spending for plants and equipment is revealed by survey

● FOUNDRIES expect to ship about 10 per cent more tons of castings in 1960 than they did in 1959. In addition, they are planning one of the most extensive capital investment programs in recent years for plant improvements, new foundries, and equipment purchases.

This is the outlook revealed by replies from a representative cross section of the industry to a questionnaire sent by FOUNDRY to 2700 foundries.

On the Nose—A year ago when foundries were queried about 1959 business prospects, they predicted an increase of 20 to 25 per cent in production compared with 1958. They were remarkably accurate in their predictions—1959 tonnage exceeded that of the year before by slightly under 25 per cent. The gain would have been considerably larger, however, had it not been for the effects of the steel industry strike.

The 1959 production of slightly over 16 million tons compares with 13 million in 1958, 16½ million in 1957, and 18 million in 1956. Because the steel strike and potential labor difficulty among the railroads tempered forecasts of foundries in predicting 1960 business, elimination of these problems easily could result in the coming year's production rising to one of the three best totals in history. Peak shipments in past years were 19.3 million tons in 1951, 18.8 million in 1955, and 18 million in 1956.

Majority Sees Rise—Viewing the industry as a whole, 65 per cent of all foundries look for increased production this year, 30 per cent anticipate no change, and only 5 per cent forecast reduced output. Steel foundries expect relatively the largest pickup in business—a gain of 10 to 15 per cent. This is not unexpected since steel foundries had a slower recovery than did other types from the 1958 recession.

Most forecasts of gray iron, malleable, and nonferrous foundries are for an increase of 10 per cent or a trifle less. Whereas 62 to 68 per cent of all gray iron, malleable, and nonferrous foundries look for better business in 1960, 75 per cent of the steel foundries are in that classification.

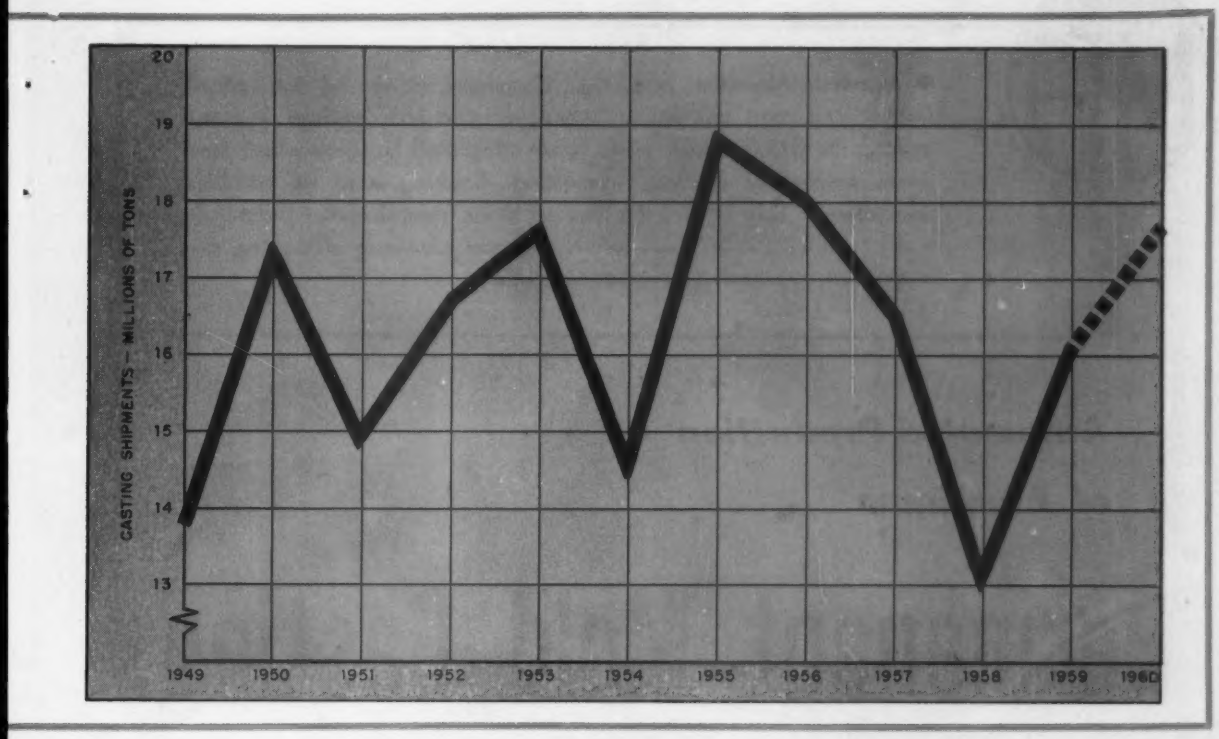
Plant size has little influence on business expectations. It will be noted in an accompanying table that the percentages of foundries ex-

How Foundries View 1960 Outlook

	Gray Iron	Malleable Iron	Steel	Nonferrous
Percentages of foundries expecting increased production in 1960	62%	68%	75%	65%
Percentages expecting decrease in 1960	5	0	2	8
Percentages expecting no change in 1960	33	32	23	27
Average increase expected over 1959	9%	10%	12%	10%

Forecasts by Plant Size

	Expect Increase	Expect No Change	Expect Decrease
Foundries employing over 250	63%	30%	7%
Foundries employing 100-249	68	28	4
Foundries employing 50-99	64	31	5
Foundries employing 20-49	64	31	5
Foundries employing under 20	60	32	8



Wide swings have marked the trend of casting shipments since 1949

Equipment Buying Plans

	Numbers of Foundries Planning To Buy the Equipment Indicated	Per Cent of Total Industry
Molding machines	1179	19%
Core blowers	914	15
Sand preparation equipment	1340	22
Core and mold ovens	294	5
Conveyors	1112	18
Cranes	282	5
Hoists	410	7
Trucks and loaders	767	13
Melting furnaces	1509	25
Heat treating equipment	466	8
Shakeout equipment	523	9
Blast cleaning equipment	676	11
Dust arrestors	337	6
Air compressors	486	8

pecting better business, no change, or a decrease are practically the same regardless of the size of the foundry.

Effects of the steel strike apparently influenced foundrymen's views of how they expect the second half of 1960 to compare with the first half. One-fourth of all foundries foresee increased operations during the second six months, and only 11 per cent expect slower business. The remainder look for little change between the two periods.

Capital Investment—This study reveals that foundries will be active participants in the strong upturn expected during 1960 in general industrial spending for new plants and equipment. A year ago, foundries indicated that they would spend relatively little on plant improvement and new construction programs. The latest survey, however, reveals that 40 per cent of all foundries are planning additions or improvements to their plants. In some cases such work represents merely a rearrangement of production facilities in the interest of improving efficiency. In other instances new buildings or additional floor space will be provided. Four per cent of the responding foundries stated that they will build new plants.

Slightly more than one-half of the larger foundries—those with 100 or more employees—indicated that they would make plant additions or improvements. About one-third of the smaller foundries fall in this category.

Plant Improvement Programs

(Percentages of responding foundries reporting plans for building new foundries or making plant additions or improvements)

	New Plants	Plant Additions
Gray iron	2%	40%
Malleable	0	55
Steel	6	50
Nonferrous	6	36
All foundries	4	40

Equipment Demand Up — Proposed equipment purchases cover a wide range and vary somewhat among the different types of machines and facilities. Principal items foundries say they plan to buy are melting furnaces and sand preparation equipment—the choice of about one out of every four companies. Other equipment expected to be in heaviest demand includes molding machines, conveyors, core blowers, industrial trucks and front-end loaders, and blast cleaning machines.

Smaller foundries are prominent among those companies with equipment-buying plans. This is particularly true of melting furnaces, sand preparation equipment, blast cleaning units, and conveyors. Comment by a number of these smaller producers cites the need for them to modernize in the interest of lowering production costs through increased plant efficiency.

● For an extra copy of this article, until supply is exhausted, use card on Page 83

● Monarch Aluminum Mfg. Co., Cleveland, is one of the nation's largest and most unusual producers of aluminum castings in metal molds. Its 312,000-sq-ft plant is an integrated complex which combines permanent molding, diecasting, finishing, and all auxiliary operations. This article, the first of three, describes the permanent mold foundry. Others will cover zinc and aluminum diecasting and a modern approach to marketing castings

Automated Production of Aluminum . . .

Permanent Mold Castings

A continuing search for efficient methods of producing aluminum permanent mold castings has led to the development of continuous melting furnaces, automatic pouring, and turntable-mounted molds

By JACK C. MISKE
Associate Editor

● EFFICIENT mass production of metal mold castings has been the objective of Monarch Aluminum Mfg. Co., Cleveland, since it was founded in 1913. Since then, the company has pioneered a remarkable number of new developments to expedite its production of both permanent mold and diecastings.

In the permanent mold foundry, cold aluminum ingots are converted to castings in just 20 minutes. Three innovations in the production setup make this unusual operation possible:

1. **Continuous melting furnaces.**
2. **Automatic pouring.**
3. **Turntable-mounted molds.**

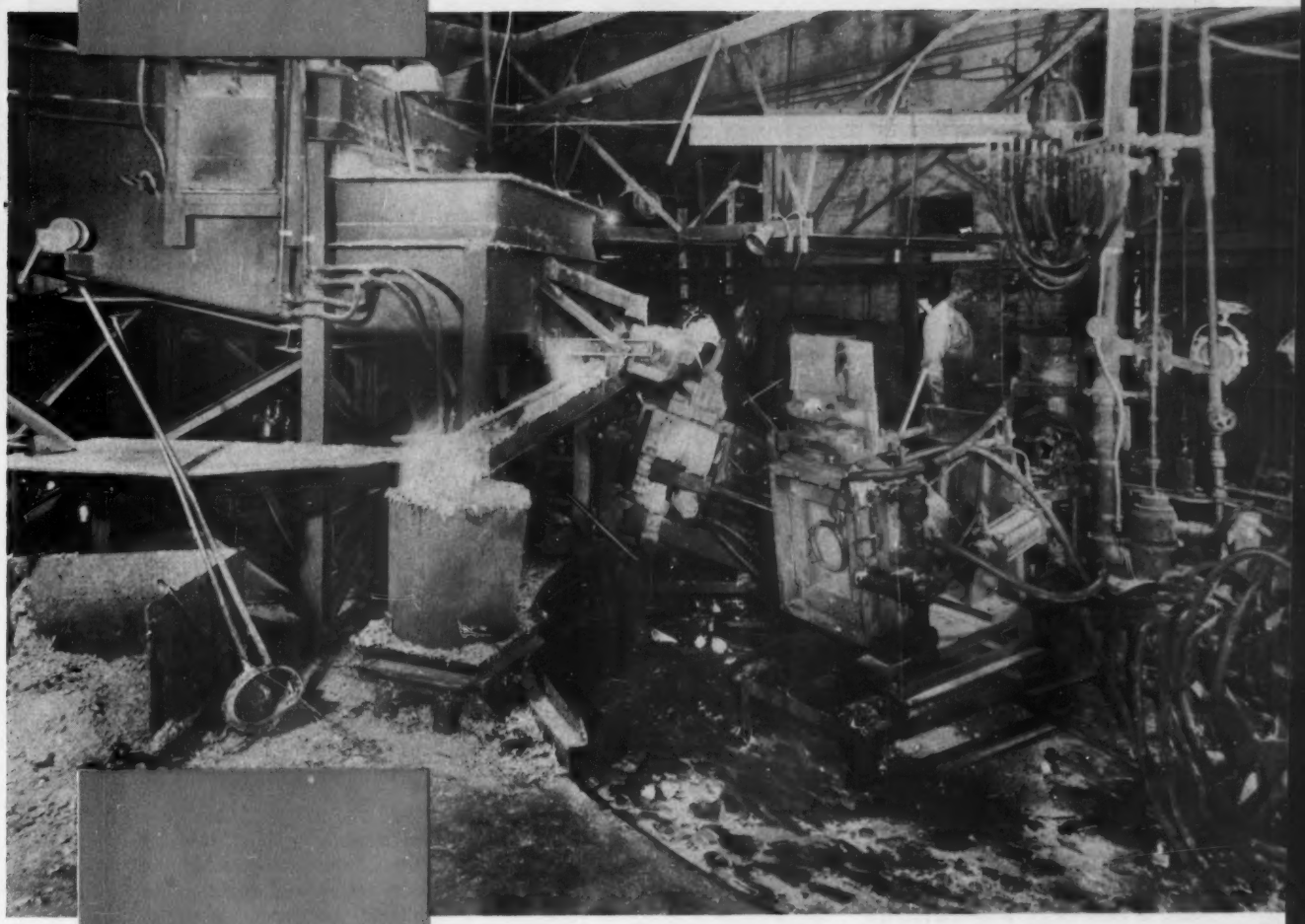
This unique combination of methods ordinarily accounts for more than 80 per cent of the company's permanent mold casting production, which amounts to between 4 and 5 million castings annually, or, it is estimated, in excess of 10 per cent of all U. S. nonautomotive, commercial permanent mold castings.

Mounting of molds on turntables came first—more than 15 years ago, during World War II. At that time, metal was melted in conventional reverberatory furnaces of capacities up to 15,000 lb and was poured by hand ladling. Today the company operates five turntables and has a sixth under construction.

About five years ago, the company installed its first continuous melting furnace and followed it almost immediately with automatic pouring. Twelve such units now are in use in the permanent mold foundry. This type of furnace is a development of Monarch personnel. It was described in detail in FOUNDRY for September, 1955, p. 143, but has undergone refinement and improvement since the time that article was published.

A tunnel-type melting unit, it employs radiant gas burners to bring it from a cold start to full operation in less than three hours. Once it has hit full production, the furnace melts ingots in 20 minutes. The largest units Monarch has built to date can melt up to 3600 lb per hour. Others melt smaller amounts —down to as little as 600 lb per hour.

Ingots are hand loaded onto a conveyor at the rear of the furnace, which slopes downward from the input end to the output end. At the top of the conveyor, a pusher mechanism automatically shoves ingots lengthwise under the roof of burners. Succeeding ingots push those in front of them through the preheating, heating, and melting zones. This mechanized charging permits a reduction of approxi-



Combination of continuous melting, automatic pouring, and turntable molds accounts for about 80 per cent of the company's permanent mold production

Spectrographic analyses are made on a designated time basis so that any metal can be certified as required

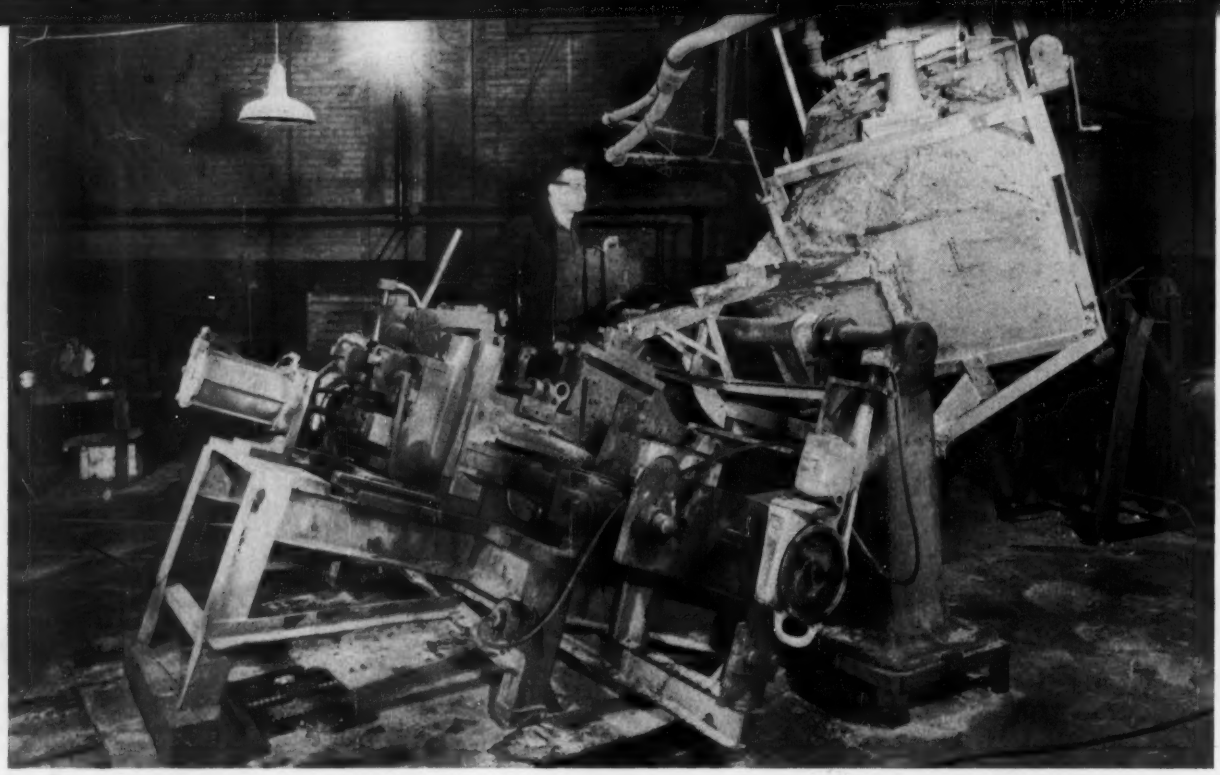
mately 30 per cent in metal handling manpower. It is used only for the larger furnaces; smaller units are completely hand loaded.

Automatic pouring was an obvious extension of this type of melting, particularly since the company already was using turntables. Metal emerges from the spout, drops directly into a small ladle, and is poured into molds as the turntable revolves. Turntables are of two types. One revolves continuously, and the other indexes molds to the pouring zone. These features are made possible by patented mechanisms.

Molds on a table vary in number from 6 to 12, depending on the size and metal volume involved. Casting weight can differ from mold to mold, provided that the proper solidification cycle is maintained. Control of the automatic pouring is achieved electronically on the indexing table and mechanically on the continuous type. If a mold has to be taken out of use, a simple adjustment can be made. Thereafter the pouring mechanism skips that position on the table.

When a mold is skipped, the furnace continues to produce at a consistent rate of flow until the charging rate has been adjusted to the lesser demand. Monarch has worked out a method of disposing of this excess metal as part of the pouring operation, and the metal is reclaimed without interrupting the normal metal flow. This same arrangement handles excess metal present for any other reason, also. In practice, however, very little metal goes into the overflow.

Scheduling Turntable Work—To be placed on a turntable, a job must meet certain conditions. First of



Continuous melting furnaces which tilt to pour automatically into floor-mounted molds are used primarily for larger castings not economical for the turntables

all, of course, it must be poured of the same alloy as all other castings being made on that table. Next, it must be in a weight range similar to that of the other jobs. The permissible range increases with casting size. Typically, one table might run castings ranging from 1 to 1¾ lb, whereas on another, castings might vary from 5 lb to 8 lb. The production rate depends on the speed at which the table revolves, and that speed in turn depends on the longest solidification time of any casting on the table.

Third, because this type of production setup is geared to volume, any turntable job normally must be in large enough quantity to run for 48 hours, or six shifts. Otherwise, setup time required to change molds would delay production from other molds on the table.

This requirement can be modified for some jobs so that a shorter run can be put on the table. The basis for this concession is the fact that some molds can be used to produce more than one type of casting by the use of removable inserts. Since the inserts can be removed or changed quickly, the other molds mounted on the table are not held up for an unreasonable length of time.

In addition, the flexibility of the furnace makes it easy to slow down the melt if a delay in metal supply is desired. It is necessary only to stop charging, 20 minutes ahead of the change, for the short period required to alter the mold. Then the furnace can be brought back to capacity in 20 minutes.

The final condition involves the design of the mold. Several basic mold designs have been developed which are applied to every job so that it ultimately can fit into some type of automated production.

It should be pointed out in connection with these limitations that production scheduling is important. For example, a job order may call for a total run which will require 48 hours on a table, yet specify delivery on a weekly basis of a 4-hour run.

It obviously is most economical to run all of such a job before the mold is taken off the table, with the customer's agreement. Weekly orders then can be filled from inventory. This procedure not only permits greatest efficiency, but also makes it possible to produce turntable jobs which could not be scheduled for a turntable otherwise.

Occasionally, a situation arises in which the molds on the production schedule constitute less than a normal minimum turntable level for that particular size and type of job. Monarch has devised several methods of handling this sort of situation through production control analysis so that an individual customer never is penalized.

Advantages of Turntables—From the management standpoint, the continuous melting-automatic pouring-turntable combination offers the great advantage of efficiency—that is, volume production at the lowest possible costs. It also, however, offers benefits for the company's customers and employees.

The customer obtains more uniform, better quality castings because automatic cycling involves fewer variables than other methods once the optimum setup has been achieved. Uniformity of solidification time, cooling, metal temperature and quality, and of other production factors produces better castings at the same time that it cuts scrap losses and mold downtime. The same uniformity of conditions also increases mold life. These bene-

fits add up to lower costs for better castings.

Employees benefit in a number of ways. Molders, for example, are required only to remove castings, spray molds as necessary, and watch the condition of the molds. As a result, they operate at a considerably lower fatigue rate since they do not pour and are not exposed to high heats. The lessened physical demands on the mold operators offer them increased job longevity in addition to reducing fatigue after a day's work. The company also profits from its greater ability to use the experience of these men and from a lower labor turnover. Use of relief men keeps the turntables in continuous operation.

Other employees benefit in that increased productivity and other advantages enable the company to enlarge its volume of business and provide more jobs at better pay. Castings are produced with fewer manhours per unit, but increased volume means more jobs.

It should be pointed out that with some of the jobs Monarch puts on turntables, more castings could be produced per hour with floor molds. Nonetheless, the total hourly production from a turntable provides a more economical cost on each individual casting. The only requirement is that no mold solidify so slowly as to reduce the optimum turntable speed.

Floor Molds—As mentioned earlier, the continuous melting furnace-automatic pouring-turntable combination normally accounts for about 80 per cent of the company's permanent mold production. Two other production setups also are employed to make permanent mold castings.

One of them employs continuous melting and automatic pouring, but uses floor-mounted molds. In this operation, a mold on rails is moved mechanically to a small continuous melting unit which automatically tilts to pour. This method is employed primarily for larger work not economical for turntable operation. Some of these castings weigh as much as 100 lb as cast, and some are cast in sensitive alloys such as A356. Such work is not placed on turntables for a number of reasons.

Essentially, the basic cost of building, operating, and maintaining a turntable operation for such castings is not warranted. Automatically poured molds of the type just described can be handled more flexibly without tying up an excessive amount of floor space when there is no production on the kind of casting involved. In addition, the company feels that application of automatic pour to this type of mold can be worked out more efficiently by specialized floor setups, which can be moved or altered as necessary.

The second nonturntable method employs continuous melting furnaces which provide a limited metal bath for conventional hand ladling. This technique is used when a run of smaller castings does not justify turntable production, when the right product mix for turntable operation is not available, or when some other circumstance such as a special alloy indicates its advisability.

Together, this trio of production methods provides a flexibility which enables Monarch to handle almost any type of permanent mold work up to a self-imposed limit. As a rule, the company does not take jobs which require overhead cranes or similar facilities to handle them. This limitation was set because the plant's operation is geared to volume which moves on fixed conveyor lines handling castings up to 15 or 20 lb.

Types of Castings — Although Monarch for years has produced a major volume of home appliance castings—particularly cookware in weights from ½ to 6 lb—the company has successfully developed many widely diversified industrial markets during the last 15 years. These castings range in weight from 5 to 50 lb and represent markets offering consistent volume appropriate for mechanized production. Typical examples are bridge rail posts produced in 23 basic designs; many types of compressor hous-

Above—In this setup, small continuous melting furnaces provide limited metal bath for conventional hand ladling. Chief use is for small runs

Below—Chester Jaworski, development foundry supervisor, left, and N. A. Jannetto, permanent mold foundry superintendent, look over a new mold

ings; lawnmower housings and operating parts; commercial machinery parts; furniture; and architectural and construction items.

Molds—Monarch operates a modern tool shop devoted mainly to mold construction and maintenance. All molds are designed by the engineering staff. It still is necessary to use a limited number of local tool shops to handle the total volume of mold construction, but all gating is done by Monarch. X-ray examination of final gating results is maintained rigidly. Constant research is applied to new ideas and refinements in mold design and operation.

To aid in the achievement of optimum operating performance, the company maintains a small development foundry area in which all new molds are put through their paces before they are placed on a turntable. This department establishes casting weight, solidification time, and similar important factors, all of which will contribute to a successful production run in terms of both the customer's and the foundry's interests. As a byproduct, it also serves as a training section for new molders.

Types of molds used in the various production setups include full permanent molds, in some of which collapsible metal cores are used, and semi-permanent molds in which sand cores are used. Molds usually are constructed of carefully controlled gray iron.

The greater control of molds which is exercised through use of the turntable method reduces conditions leading to metal fatigue and extends mold life beyond ordinary limits. Some turntable molds have given life comparable to that of die steel dies used in diecasting. When practical, die steel inserts have been used to lengthen mold life, too.

Every mold is cleaned and sprayed once a day, plus touchup spraying and maintenance as required during the day.

Monarch does not use unit molds —that is, molds in which two or more different castings are poured at the same time. As stated earlier, it does employ molds in which inserts can be changed to permit use of the same basic mold for different castings. Instead of unit molds, the company has tended to operate smaller molds on more and faster turning turntables. Multiple-cavity molds for identical parts are employed, however, when they are practical to adapt smaller jobs to turntable operation.

View of the chemical laboratory. Physical laboratory is in adjacent area. Together, they provide complete testing facilities

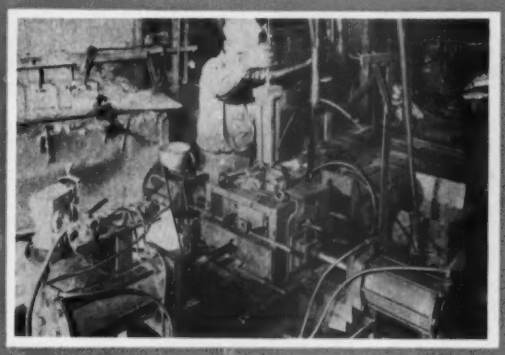
Metal — Primary aluminum is used predominately in permanent mold production to meet customer specifications. Close laboratory control is maintained over all melting operations on a designated time basis because of the continuous melting methods. This control makes possible complete certification of metal used on any job to meet all customer certification requirements. Alloys usually run in permanent molds include 12, 43, 2314, 355, 356, A356, 319, and B195.

Gates and runners can be identified readily by alloy and a percentage is charged into the furnaces under careful metallurgical control without interrupting melting operations.

Monarch does all its own heat treatment on those castings which require it. Impregnation can also be performed if specified.

Inspection—Casting inspection begins with the man who removes parts from the mold. He segregates defective castings on the overhead conveyors which move all castings to hot inspection and to finishing. The mold number appears on every casting, and inspectors in hot in-

Modern tool room constructs and maintains molds. Some molds are made by local tool shops, but all gating is done by the company



Molder inserts a metal core in full permanent mold. Jobs of this nature are the exception at Monarch, which emphasizes high volume

spection use a loudspeaker arrangement to call attention to any mold which is turning out consistently bad castings. Additional inspection is made in each finishing department as castings are processed.

Under this system, each department inspects the work of the preceding one in addition to watching for foundry defects which can be discovered only after certain secondary operations. Consequently no finishing defect is allowed to perpetuate itself for very long. Final inspection is made when castings are packaged for shipment.

Foundry defects are minimized by a number of techniques. The consistency of metal molds is important, for one thing. So long as molders watch the condition of their molds, castings should be produced properly unless some other factor is off. Spectrographic analysis, tensile testing, and metal analysis are used as circumstances and specifications require. In addition, spot internal radiographic checks insure that castings are running properly at all times.

Engineering Analysis—An important part of Monarch's quality control relates back to its approach to casting production. Experienced engineering analysis does a lot to avoid foundry problems before a part is made. This approach begins when the customer's proposed design is being estimated for quotations.

Qualified personnel determine the proper casting method and design requirements. If modifications are required, they are made by mutual agreement with the customer, and final part drawings are submitted for approval. At that point, the mold can be made and the job scheduled with every confidence that the best possible casting will be made at the lowest possible cost and with the fewest possible production problems.

An important element of this process is the manner in which the production and sales functions work together to produce a good product mix at satisfactory costs. Beyond that, successful operation of this high-volume, low-cost foundry operation necessarily depends on the co-operation of the entire work force, and that co-operation has been achieved by a continuing educational program.

Finishing—A high percentage of the company's castings receive some degree of secondary finishing before they leave the plant. The degree varies with the customer's requirements. About 80 per cent get some secondary finishing, and about 50 per cent are sent out completely finished for assembly. Only 20 per cent are shipped as trimmed, rough castings.

Two unusual finishing processes are worthy of particular mention.

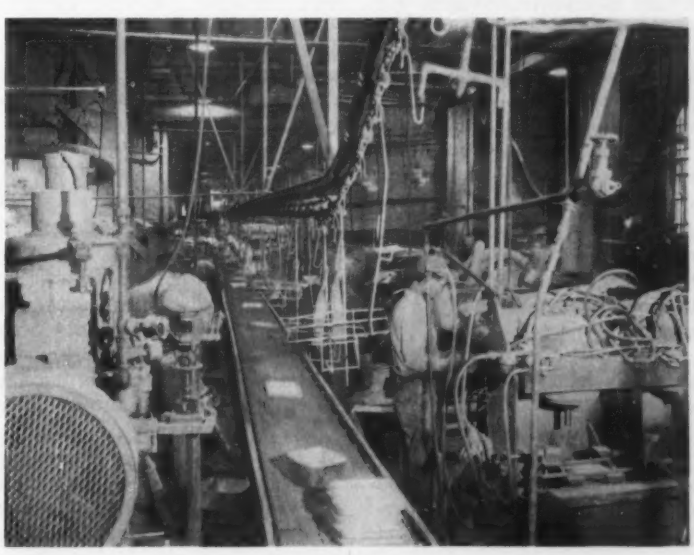
One is Velvaglaze, which maintains the natural aluminum surface without additives or changes in metal structure, but provides a velvety smooth finish which resists mars, scratches, and surface stains. It also can be produced in textures to meet any specification desired. This finish is available on either permanent mold castings or aluminum diecastings.

The second is Porceglaze, a combination of the color and surface protection of porcelain enamel with aluminum castings. It does not spall, withstands thermal shock, and is resistant to abrasion, acids and alkalies, flame, and salt. It currently is used only on permanent mold castings made of a Monarch-designated alloy.

Next Month—The second article in this series of three will appear next month and will describe Monarch Aluminum's unusual aluminum and zinc diecasting operation.

● For an extra copy of this article, until supply is exhausted, use card on Page 53

About 80 per cent of the permanent mold castings produced at Monarch get some secondary finishing. This is the preliminary machining department



Cutting Scrap Losses through

Process Improvement

Process capability and improvement are important considerations in reduction of scrap that results from foundry operations. Most defects can be held at a minimum because of major technical advances

By KENNETH M. SMITH
Foundry Consultant

● ACCORDING to available information, most American foundries are saddled with scrap losses in excess of 5 per cent. A number of the really unfortunate ones grope along under a burden of 10 to 20 per cent unsalable castings.

To find a single solution to this great problem, exhaustive studies have been conducted in both high and low-scrap foundries. Out of this work has emerged the theory of process improvement. The basic concept is that there is no such thing as high scrap without poor processes and that all foundry scrap over 4 per cent points to inadequate processes as the major cause. During the last three years, a number of foundries have tested the theory and found it valid.

All foundries go through at least one period of process improvement. In a new foundry, it may take up to two years to acquire a fairly satisfactory set of processes. The question of further interest in process improvement depends, to a large extent, on management's ability to recognize these facts:

1. That the original process development may have stopped short of the potential.

2. That even an excellent process can be allowed to deteriorate.

3. That industrial changes, such as a lessening of skilled labor responsibility or a tightening up of customer requirements, call for new or more nearly foolproof processes.

Theory of Process Improvement— A dictionary defines a process as "a series of actions or operations leading to some result." From this description, we can identify melting, molding, coremaking, and cleaning as the major foundry processes.

The definition contains no reference to the relationship between process and jobs, but we can add an interpretation of our own. We can say, "Jobs are to a process as cars are to a highway." If the highway is full of holes and bumps, many cars develop blowouts, broken springs, and misalignments. Similary, foundry processes full of holes will produce higher percentages of defects in castings. In a smooth process, as on a smooth road, defects are the exception rather than the rule.

The fact that one would rather travel on a smooth concrete road than on a smooth dirt road is the difference between the process capabilities of each. This concept supplies us with another definition and a rather obvious comparison between the same process in different foundries. Process control, on the other hand, has to do with how well the road is kept in repair. Since one of our main objectives is to show that job problems are few when all processes are good, we should keep the above definitions in mind as we continue.

Process Capability Varies — The basis for the process improvement theory came about through an interpretation of statistical control information. Once it became clear that foundries differed to a much smaller degree in control than in process capability, however, it also became apparent that statistical control is not absolutely essential to process improvement.

A poor process betrays itself through the defect that is consistently above 0.5 per cent. In some foundries, the annual level of one defect or other is as high as 3.0 per cent or more, but unless every defect is held to 0.5 per cent or under, total scrap figures of 4.0 per cent are practically impossible.

Because of major technical advances during the last few years, most casting defects can be held between 0 and 0.3 per cent. In present foundry practice, only four types of defect (mostly nontechnical in nature) require special effort to be reduced to 0.5 per cent. In small and medium-sized castings, one rarely finds a malleable or gray iron foundry in which the four most common defects are not misruns, shifts, sand inclusions, and broken castings. These four we will refer to as major defects and all others as minor defects.

Whether a defect be major or minor, it is partly by comparing methods in numerous foundries that we become aware of the process limitations in some and find evidence that process capability and process improvement are prime factors in relation to size of the scrap pile.

The Process and Its Results — Process improvement evolves from two main considerations—measuring the process itself and measuring its results. The first is accomplished through establishment of process requirements or control limits, the second by keeping in constant touch with weekly and monthly levels of each defect. We start by being interested in a high-percentage defect, next deciding what requirements are needed to reduce the defect level, and then making sure that the requirements are followed.

If results do not reflect the anticipated reduction, the requirements are inadequate and must be changed. All requirements and changes in requirements should be tied in with a particular defect and directed to a specific action or operation within a given process. Most foundries use various types of molding methods. Each requires at least partially different processes and should have a separate production and scrap report to facilitate process improvement work.

All process improvement work has a few factors in common. In each, a defect above the 0.5 per cent level presents the challenge. Then comes observation of the operation within the process from which the defect has its origin. Observation changes into investigation when an apparent fault is discovered in the operation. The fault may be an inconsistency which penalizes any job that happens along at a particular time, such as the mold which receives the bad jacket or the pattern plate which is fitted to the wornout flask.

On the other hand, the fault may be entirely consistent with all jobs receiving the same treatment. An example is a set of tight flasks, in which all of the pins and bushings have worn beyond the limits of allowable tolerance. Both the consistent and inconsistent types are responsible for process limitations which should not be treated as a matter of control until (1) the fault has been recognized, (2) process requirements have been set up to avoid the fault, and (3) ability to meet the requirements has been fully proved.

Is a particular problem one of process capability or a matter of control? How this question is answered can make the difference between success and failure in efforts to improve foundry processes.

Setting the Limits—From a practical standpoint, we have certain advantages in treating control as "a matter of making up our minds to operate within clearly specified limits." Since the dictionary definition of control is "staying within limits," the concession to the practical is largely one of establishing intent. So much lip service and so little adherence have been given to the subject of control limits in many foundries that the term has lost much of its original meaning.

When anyone in authority ignores control limits, condones the go-ahead beyond the limits, or takes no initiative in setting up limits when needed, the purpose of the limits has been denied. Both the variations and the results should be recognized as an integral part of the process, rather than a matter of being out of control. To avoid the confusion of on-again, off-again control limits, we should exercise more care in setting up the limits.

Set only limits you are determined to enforce. If any exceptions are to be allowed, spell them out, and set limits on them, too. Be sure that those concerned understand the limits, receive a list of all process requirements, and are given instructions to eliminate from the product all conditions outside the limits. With such a policy, it is simple to distinguish between a problem of control and one of process capability, whether it concerns men, materials, machines, jobs, or processes.

Knowhow Is Needed — Process improvement work requires a particular kind of knowhow of which the foundry industry is in great need, but has a short supply. Men with this knowhow are being developed through programs which stress the process improvement aspect of quality control as well as the control aspect. The shortage of process improvement knowhow can be understood by recognizing that many foundrymen have had excellent experience in solving job problems, but very little in even maintaining a process, much less improving one.

This fact is complicated by another—many of the considerations important to a good process are different from those effective for an individual job. For instance, we usually give special attention to a bad job because of very high percentages

in one or two defects and tend to discount defects of 2 or 3 per cent as unimportant. Yet the 2 per cent might be in the form of misruns, with a similar amount, from the same cause, on almost all jobs because the beginning of each day's heat was poured with low-temperature metal.

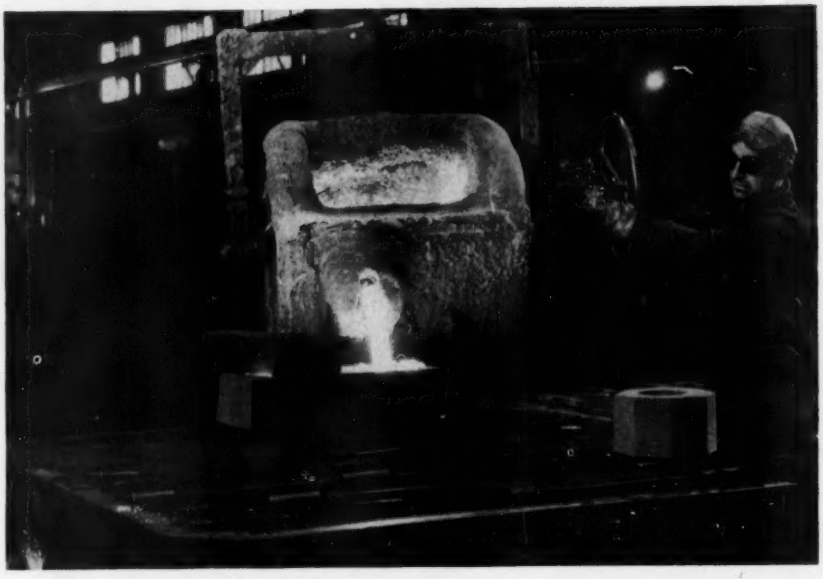
A process that produces an average of 2.0 per cent in a single defect is a matter of critical concern, whereas in an individual job that rate rarely is so critical. A quality control man, working on process improvement, would be tremendously interested in cold metal at the beginning of the heat.

Space does not permit a review of the over-all qualifications of a good process improvement man. Men of technical background usually are chosen, but good results have been had within the first six months of a program handled by someone chosen from the ranks of supervision or by a promising young man of limited foundry background. In either instance, success has depended on a specialized training program, directed by an expert in foundry quality control.

Why Improvement Lags — So far, we have tried to demonstrate that high-scrap foundries have not improved their processes to a satisfactory level. Many managements which have become convinced by the evidence want to know the reasons behind the lack of process improvement. Therefore we had best mention some of them as a warning to other foundrymen. The expression "He cannot see the forest on account of the trees" probably best explains the tendency of foundrymen to blind themselves to process problems through overemphasis on individual jobs.

How many of us have licked the worst jobs each month, only to find that we have failed to reduce the over-all scrap figure? This failure occurs because we have established a policy of robbing Peter to pay Paul, and it is what has been happening to a long line of Peters that supplies us with the evidence of bad processes. A second reason has to do with a satisfactory yardstick for measuring process capability and separating the abnormal performance of jobs which do not fit the existing process.

A discussion of this subject appeared in FOUNDRY articles by the writer in the March, 1957, and June, 1958, issues. But neither of the above two reasons, valid as they may be, actually gets to the heart of the problem as does what follows.



Low pouring temperature and low pouring speeds are the principal causes of misruns, one of the four most common defects foundries encounter

Process improvement never can come about in an atmosphere of compromise since all process requirements are designed to prevent compromise. Admittedly, every foundryman has to accept compromise as a necessary function of the business; we are living up to the principles of good business when we compromise intelligently. The types of compromise that invite disaster are the kind that are unplanned, unwanted, or of an emergency nature. Such compromises almost invariably become a habit from which the only possible gain is in the form of a daily salvage which in turn destroys the climate for process improvement. This negative cycle is completed when high-defect levels are perpetuated into long-term losses.

Relationship to Control — The final argument for process improvement takes us back once more to its relationship to control. The foundry industry has been feeling its way into an age of statistical controls. The benefits of this tool depend as much on knowing what it cannot accomplish as on what it can. Properly interpreted, certain types of statistical controls do reveal process capability, but, by and large, they are not designed to extract more from a process than it contains.

Much misunderstanding can be avoided by remembering that a perfectly controlled bad process results in consistent but repetitively high scrap figures. It takes good processes plus good control to get and maintain low scrap figures. Statistical controls are not essential to guide process improvement work, but they are extremely valuable, through their ability to aid control of both process and jobs, to any process which has been improved to the point of being good.

It is important to treat process improvement as the vehicle which carries us to the low scrap figures and to regard control as the walls which prevent these figures from slipping away. Several articles have been written about "The Average Job Quality Control System" in which control has been covered extensively. Now, with the aid of material drawn from the many foundries using the system, the present article on process improvement completes the information necessary to an adequate description of the method.

Practical Value of Process Im-

provement—In quality control (and other foundry functions as well), the opportunities to apply the principles of process improvement successfully are practically unlimited. In dealing with specific case histories, we will concentrate mainly on those that have made possible large-scale reductions in the garden-variety type of casting defect. The following selection, therefore, is a composite of the most effective for small and medium-sized castings, in jobbing and production foundries which make a wide selection of gray iron, malleable, and nonferrous castings.

Readers should remove from their minds all thoughts of individual jobs. Job problems are an entirely different phase of quality control, not covered in this article.

Misruns

Logically enough, low pouring temperature is the largest single cause of misruns; yet some foundrymen rationalize that metal delivered to the pouring station must be poured, regardless of temperature. Since most misruns can be avoided simply by not pouring low-temperature metal, it is obvious that the mere presence of cold metal is not a legitimate cause of the defect.

With due consideration of practicability, the following minimums are only a few degrees above the danger zone, yet are sufficiently high to avoid misruns on most properly gated and poured jobs: 1. *No gray iron casting shall be poured below* 2550° *F.* 2. *No malleable casting shall be poured below* 2650° *F.*

The first result of enforcing the minimum-temperature requirement is an increase in the amount of pigged metal. This condition can be overcome by learning to melt hot and to conserve metal temperature. Good average spout temperatures for cupola gray iron are 2800-2830° F; for air furnace malleable they are 2900-2950° F. Between spout temperature figures and the minimum pouring temperature requirement, we have an allowance of about 250 degrees for mixing, transferring, and pouring.

The allowance is adequate, but not ample. We must spend each degree wisely and have a few left over, if possible. A torch in the receiving ladle reduces the loss at that point by 30 degrees or more. More torches for transfer and pouring ladles take care of the beginning of the heat, rest periods, eating breaks, and other interruptions. Allowing slugs to solidify in ladles, or nearly so, is a common but deplorable practice which should be stopped.

In foundries unaccustomed to metal temperature conservation, time is the most important factor overlooked. For example, pouring ladles, all except large ones, lose metal temperature at the rate of 5 to 15 degrees a minute. Covered ladles, of course, favor the low side of the range. Temperature loss also depends on the speed with which men move metal. All in all, there are many ways to meet temperature requirements and avoid pigging, if we make up our minds to do so.

Low pouring speed has been recognized as the second largest cause of misruns. Only a few foundries have established a policy of keeping sprues full during pouring, in spite of the fact that gating changes cannot be justified on any other basis. Shops which have not adopted the full-sprue policy not only experience higher percentages of misrun and slag defects, but, as an aftermath, discover that they have allowed a complete set of malpractices to develop gradually in the molding process.

As might be expected, easy pouring permits improper weighting of molds, inadequate print-back of cope and drag, faulty jackets, low mold hardness, and higher permeability of molding sands. An exorbitantly high price is paid for these dubious advantages. The main process requirement to avoid misruns caused by low pouring speeds, is this: *All sprues shall be kept full during the pouring operation.*

When proper pouring practice has been established, the aforementioned malpractices express themselves in higher percentages of strain, swell, runout, and roughness defects, which will be discussed later. Because there is no way of anticipating to what degree malpractices have developed except through the full sprue test, we have little choice but to make that test.

If only an occasional job gives trouble, the full-sprue policy should be shopwide, stopping for curative action the few that need attention. If a large number of jobs acquire these defects, however, the only sensible thing to do is to fix one job at a time for proper pouring, making sure that the full-sprue requirement eventually is applied to all jobs.

Despite the common need in all foundries to establish and enforce process requirements of a type identical or similar to those described here, some foundries, because of a wide gap between present processes and those desired, prefer to reach their final process goals by stages. In the fast, one-step method, the danger is a greater temptation to compromise. In the slower approach, we temporarily are blinded to the final benefits. In both, however, the end result is the same, provided that we do not allow the the program to bog down along the way.

Remember that it is the job of the quality control man to police all process requirements, reporting each observed deviation to both foreman and superintendent. The standard procedure is to spot check at random times throughout the day. As deviations become fewer in number, the period between checking is lengthened.

Shifts

Process requirements to avoid the shift defect on squeezer and small cope and drag castings should be designed to meet the specifications of our most critical customers that shifts of more than 0.0156 in. will not be accepted. Even this figure, small as it is, probably will be reduced in the near future, for any shift at all is undesirable and has been granted reluctantly. Many variables are involved in this defect, but the most important ones have to do with the condition of flask equipment.

It is not just coincidence that a pattern with a bad shift history often performs well when rigged in a new matchplate flask. If more foundrymen would inspect a new flask to observe the care that has been taken to have every important part in almost perfect alignment and adjustment, they might try harder to prevent the abuse that

usually increases with the age of the flask.

The tendency to fit copes more and more tightly, until it requires some force to pry the halves apart, causes the pins to tip inward, the guides to fit and wear abnormally, and the cope half to become permanently larger than the drag half. All of these conditions add to the problems of avoiding shifts. Unfortunately, stopping the abuses will not overcome entirely the damage that has been caused. The main process requirement is in keeping with all other concepts of good foundry practice: *Flask equipment shall be kept in proper adjustment at all times.*

Squeeze pressures that are too high or unevenly applied, because of high pattern or blind riser projections, have been found to cause a type of shift that follows one direction on one end of the mold and the opposite direction on the other end of the same mold. The cure for this problem does not lend itself to establishing a process requirement in the accepted sense, but just knowing the cause should be enough to prevent repetition.

One more of the many causes of shifts should be discussed briefly. Squeezer molds that have to be moved mechanically or carried manually for some distance are subject to the shift defect in almost direct proportion to the amount of joint contact area between the cope and drag. We can test the amount of contact area on any mold simply by shaking a dry parting compound on the drag half of a finished mold and coping off again.

We shall refer to this action as measuring the print-back quality of the mold, and we should reject all new patterns that show print-back capability of less than 80 per cent of the possible contact area. Old patterns should meet this specification or have the joint reworked. Causes for low print-back quality should be corrected wherever they exist. They include these: Jolting of copes on matchplate work, improperly made patterns, worn pattern joints at flask contact areas, and oversized cores. The following process requirement has been found necessary: *The joint contact area of all squeezer molds shall exceed 75 per cent of that possible under ideal conditions.*

Breakage probably is the most neglected of all casting defects. Its chief cause appears to be human rather than mechanical

Sand Inclusions

To work effectively on the causes for sand inclusions, the first, and perhaps the most difficult, problem to solve is that of classifying the defect properly. Crush, wash, slag, and scab defects must be weeded out. What is left usually is a fair approximation of a defect we can properly describe only as sand inclusions because there is no visible connection between it and any part of either the casting surface or the gating system.

Sources of such sand inclusions include sand particles (1) blown into the mold by activities of a nearby worker, (2) dropped in by weight and jacket shifters, (3) introduced by the molder while he makes the mold, (4) spilled from overhead conveyor belts and moving crane loads, and (5) caused to fall into open sprues and risers by the traffic of gangway equipment such as front-end loaders and wheelbarrows.

By a tremendous margin, the greatest single source is plain old sloppy molding. The variation in human performance seldom causes any other defect to the degree it does sand inclusions. Month after month, the same men produce high percentages, and the same few have a consistently low figure.

This finding is in direct contradiction to the bad sand claim we hear so often, and let's hope the challange will not go unheeded. The evidence which points out a careless molder is the number of sand particles we find in his molding sprues. The neat molder (often the best producer, also) may have trouble with other defects, but he will not produce many molds with dirty sprues or many castings with sand inclusions. This process requirement is all that is needed: *None but clean molds shall be accepted.*

Process improvement is based on a spotcheck flashlight inspection of sprues and a follow-up by the foreman to insure that the clean mold policy is enforced. It rarely is necessary to observe the interior of the mold when the sprues are clean.

Broken Castings

A broken casting is different from other scrap castings in two important respects. First, almost all broken castings once were good ones. Second, breakage probably is the most neglected of all casting defects. It has been proved time and time again that castings can be handled with breakage figures consistently under 0.5 per cent.

Mechanized handling deficiencies usually can be corrected at low cost, and tumbling mills can be packed properly and repacked when necessary. Most foundries produce at least a few jobs which do not lend themselves to mechanical handling or tumble cleaning. These

should receive special consideration, even to the extent of setting up processes for manual handling and table blast cleaning.

The chief cause of broken castings appears to be human rather than mechanical. More men are involved in this defct than in any other, and many widely separated operations—spruing, cleaning, chipping and grinding, inspection, shipping, and transportation—are involved. Some shops have found it advantageous to train one or two men to do all spruing of jobs that are delicate or difficult to sprue without breaking-in at the gate.

There is no doubt that handling instructions are important to process improvement efforts to minimize broken castings, but the following process requirement has accomplished more results than any other consideration: *All castings shall, at at all times, be handled with whatever care is necessary to guarantee breakage figures of less than 0.5 per cent. Each worker must be certain, in his own mind, that broken castings cannot be the result of his treatment.*

As in other process requirements, a daily spotcheck is necessary to identify any man who deviates from the requirement.

Strain

The main cause for the strain defect on squeezer castings is improper mold weights. A number of foundries have settled on a weight which has three parallel slot openings, weighs 80 lb, and has handles on top for easy shifting. Faulty jackets need no discussion. Remember that a low percentage of print-back will cause fins on castings when no strain is present. Above all, do not try to avoid the strain defect by penalizing the misrun and slag defect levels. Attacking the direct cause provides the best solution.

Slag Defects

Because most foundries experience only spasmodic trouble with the so-called minor defects, we will mention just the chief causes for process limitation in a few of them and suggest process requirements as deemed necessary. The main requirement to avoid slag defects is to maintain the full-sprue policy. Large molds must have slag held back until the pouring basin is full.

Shrink

A recent report by an eastern research group has verified previous claims that mold-wall movement is a major cause of a common type of shrink. In several shops, a sudden epidemic of the shrink defect has been stopped cold by increasing mold hardness. One of the main requirements, therefore, is the same as for the swell defect, which will be described next.

Swell

This defect is the first of four responsible for a fear which has been the underlying reason for failure to keep sprues full during pouring. If properly rammed molds really were subject to the swell defect, molds with deep copes and high ferrostatic pressure would be beyond our ability to produce.

For many valid reasons, the modern trend is toward mold hardness figures as high as 90, and molding sands with the necessary properties have been developed. Most shops are not yet prepared to establish a high mold hardness minimum, however, and, because it is common to find some molds as low as 50, the following requirement should be met in all shops and increased as sand properties and equipment make it possible: *A minimum mold hardness figure of 70 shall be maintained on all green sand molds.*

Runout

The last advice applies equally well here. There is no need to discuss the causes and cures for the runout defect other than to state that fear is a poor substitute for the action that should be taken.

Roughness

To be concerned about moisture variations, permeability, grain fineness, and carbonaceous content of molding sands is to attack the direct causes for the roughness defect. It should be apparent that the unnatural tie-in in many shops between misrun, slag, swell, strain, runout, and roughness defects must be broken before all six can be reduced to satisfactory levels.

Sticker and Tear-up

Major causes of these two defects more often appear to be questions of flask adjustment and squeeze pressures than of dry or wet molding sand and damaged patterns. The following process requirement is important to the cure and future prevention because in most instances the problem can be solved on the spot as it occurs: *All molds involved in the sticker or tear-up defect shall be reported to the supervisor immediately, and after investigation has been completed, the defective mold shall be destroyed.*

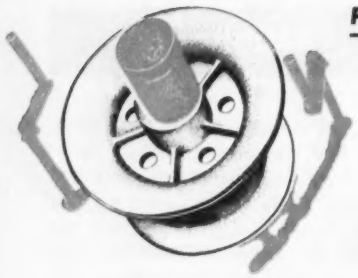
Crush and Shave

To avoid these defects, several process requirements are needed to spell out the proper procedures for gaging and setting cores, closing copes, and clamping molds.

Conclusions—These examples of process improvement, helpful as they have been in lowering the scrap levels of a number of foundries, barely scratch the surface of the opportunities for exploring the field.

The continued growth of quality control in our industry affects the welfare of every foundryman. By diverting some of our more talented men from job problems or other activities and training them to develop and improve our operations and processes, the future total of all casting defects can be reduced to a level below that attained by the products of other industries.

● For an extra copy of this article, until supply is exhausted, use card on Page 53



Fourth of a Series

By R. W. RUDDLE
Technical Manager
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Cleveland

RISERING
Copper Alloy Castings

Modes of freezing and effect of alloying are discussed in relation to the feeding of copper alloy castings. Determining riser size, shape, and feeding range are covered for groups of alloys

● FOR EASY understanding of the way in which risers operate, we first must consider how copper alloys freeze.

Modes of Freezing—These alloys, and indeed the alloys of any metal, differ markedly as to mode of freezing. These differences depend on constitutional factors such as freezing range, rate of diffusion of alloying elements, and thermal conductivity. Cast in sand molds, pure copper and its short-freezing range alloys freeze by a mechanism sometimes known as skin formation.

Freezing begins by the crystallization of several small crystallites at the mold walls. The more favorably oriented of these grow rapidly into the melt, both sidewise and forward, quickly linking up with their neighbors to form a continuous front known as the solidification front. Thereafter, freezing proceeds by the advance of this front into the interior of the casting.

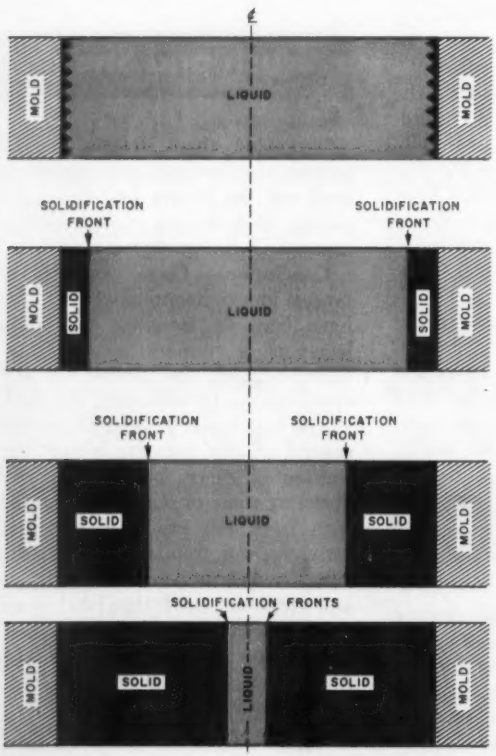


Fig. 18—Freezing mode of pure metals. Crystallization begins at mold wall and advances into the casting interior as an uninterrupted solidification front

This mode of freezing is shown in Fig. 18. It is typical of that of pure metals and (to a first approximation) of alloys close to the eutectic composition. If the pure metal contains a small amount of an alloying element or traces of impurities, the mode of freezing is little altered, except that instead of being smooth, the solidification front is roughened due to the somewhat dendritic growth of the crystals (Fig. 19).

Effect of Alloying—Long-freezing alloys which contain substantial amounts of alloying elements freeze differently. As before, freezing begins by the deposition of crystallites of metal on the mold walls. With these alloys, however, growth of the first crystallites formed is retarded severely or temporarily even halted completely almost immediately after they have been formed. The reason is that in a normal alloying system, the initial crystallites frozen from a melt of given composition are considerably poorer in the alloying element than the melt itself. When such a crystallite is formed, atoms of alloying element therefore are rejected into the surrounding liquid, thus greatly enrich-

ing this liquid in the alloying element.

This process substantially lowers the freezing point of this liquid so that crystal growth can not continue. Continuing heat extraction by the mold then slightly lowers the temperature both of this liquid and of the liquid in the unaffected region beyond it, toward the interior of the casting. This lowering causes a second batch of crystallites to nucleate just outside the enriched region (Fig. 20). Growth of this second batch of crystallites is restricted similarly and a third batch of crystallites quickly forms still farther toward the interior of the casting, in the unaffected region just beyond the enriched region which now surrounds the second batch of crystallites.

This process is repeated rapidly time and again until small crystallites have been nucleated throughout the entire volume of the casting, as shown in Fig. 21. Freezing then continues by the gradual enlargement of all the crystallites, this process taking place simultaneously throughout the entire casting. For obvious reasons, the crystallites closest to the mold wall grow slightly faster than those near the center of the casting, but the differences are not particularly great.

The sequence of events in this type of freezing is illustrated in Fig. 21. The process may be likened to the setting of cement, the material as first being fluid, then mushy, and finally rigid.

No Sharp Transition—Naturally, as the alloy content of copper is increased from zero to a value which gives rise to the pasty type of freezing described above, there is no sharp transition from the skin-forming mode of freezing to the pasty type of freezing. In practice, intermediate types of freezing are observed in certain composition ranges. In a typical intermediate case, the first crystallites formed would have their growth somewhat restricted, but not altogether stopped.

Growth takes place in a dendritic fashion, long thin dendrites attached to the mold walls being formed, as illustrated in Fig. 22. Space between dendrites is filled with enriched liquid which freezes very late in the freezing process

Fig. 19—The freezing mode of alloys of short freezing range

because of its low melting point. Frequently, the growth of the dendrites peters out altogether at a certain stage, as shown in Fig. 22. Pasty freezing takes place in the central region of the casting and gives rise to an equiaxial structure there. Both ordinary skin formation and the dendritic type of freezing give rise to columnar structures.

The intermediate type of freezing illustrated in Fig. 22 shares an important feature with the pasty type of freezing shown in Fig. 21. Freezing proceeds at the same time throughout the entire casting, some of the metal at the mold wall remaining liquid until a very late stage in freezing. There thus is no kind of fully solid shell produced as in the true skin-forming type of freezing. Bronzes and red brass frequently solidify in this way.

Influence on Shrinkage — These different modes of freezing are extremely important from the point of view of feeding the casting since they control the type of shrinkage to which the alloy is subject. When skin formation takes place, the regions of the casting adjacent to the mold wall almost invariably are completely solid. Shrinkage occurs as internal cavities, which may be of considerable size, at the heat centers. In platelike or barklike sections, centerline shrinkage is produced, again with large cavities (Fig. 23).

On the other hand, in alloys freezing in the pasty manner and also those freezing in the intermediate manner illustrated in Fig. 22, the growing crystals or dendrites compete for the remaining liquid at scattered locations throughout the entire casting in the final stages of freezing. For this reason, it is not difficult to see why these modes of freezing give rise to dispersed porosity. Pasty freezing, as illustrated in Fig. 21, generally produces microporosity, which is highly dispersed. The intermediate types of freezing, illustrated in Fig. 22,

Fig. 21—Freezing of an alloy of long freezing range cast in a sand mold is diagrammed

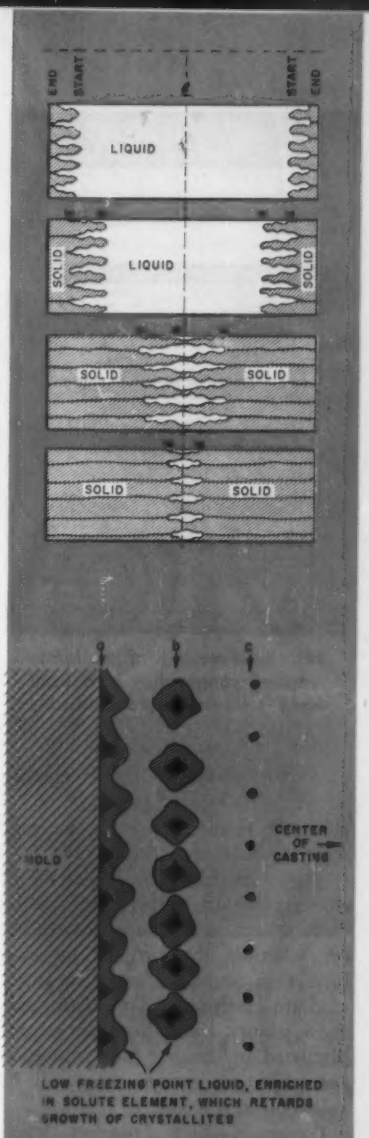
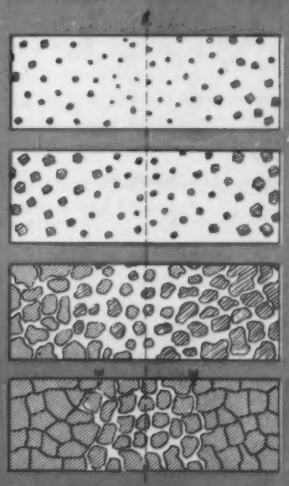


Fig. 20—Freezing mode of long freezing range alloys. a. Crystallites formed on mold wall. b. More crystallites form when growth of the first crop is retarded. c. A new crop starts



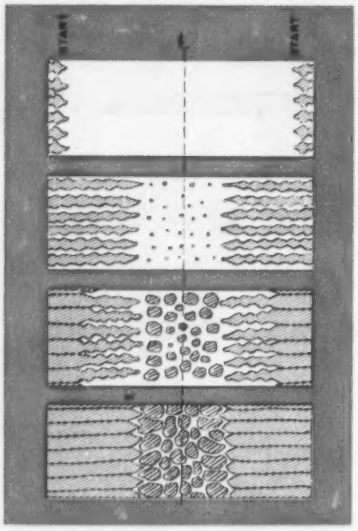


Fig. 22—Freezing of moderate freezing range alloy in a sand mold is shown diagrammatically

give rise to rather larger cavities which, although dispersed, tend to be more concentrated in the central regions of the casting (Fig. 24).

These differences in the mode of freezing permit copper alloys to be divided into two groups, depending on whether they freeze by skin formation or in the pasty or intermediate fashion. To distinguish these groups from the alloy groups discussed in the previous section of the paper on gating, they will be called Groups X and Y:

Group X—Skin Forming Alloy: Copper (deoxidized or oxygen-bearing); aluminum bronze; manganese bronze; silicon bronze; yellow brasses of short freezing range; cupro-nickel; and beryllium copper.

Group Y — Intermediate and Pasty Freezers: Phosphor bronze; gunmetal; leaded gunmetal (red brass); yellow brasses of long freezing range.

Risering of Alloys of Group X— The feeding technique adopted with alloys of Group X is, broadly speaking, similar to those used with steel. In other words, gates and risers are disposed so that directional freezing is set up, with due consideration being given to feeding ranges. The broad techniques used may best be illustrated by Fig. 25. This hypothetical casting consists essentially of a plate to which is attached a thinner section, C, and a boss, B.

As shown by Bishop and Pellini[10] for steel castings, the thin end of the casting C would undergo rapid cooling after pouring as the result of edge-cooling effects. Because of this "built-in" chill, it is desirable to place the feeder at the opposite end of the casting on the heavy section A so that while the end C would cool quickly, the end A would only cool slowly because of the retarding effect of the feeder.

To enhance this differential cooling effect, it also would be sensible to gate the casting close to the feeder, as indicated in Fig. 25. The flow of liquid metal would tend to heat this end of the casting, whereas metal reaching the far end would be relatively cold on arrival, thus inducing favorable temperature gradients even before freezing had started. Furthermore, this arrangement would result in the feeder itself being filled with hot metal, a situation again advantageous to directional freezing.

The boss B presents something of a problem, and unless special precautions are taken, a hot spot would form in this area and give rise to a cavity there, as illustrated in Fig. 26. This figure illustrates the position of the solidification front at successive stages in freezing and indicates the way in which a cavity (the shaded area) develops. One way of avoiding the formation of a cavity in the region of the boss is, of course, to place an additional feeder on the boss. This, however, frequently would be an objectionable procedure, and a generally better alternative is to locate a chill over the boss as illustrated in Fig. 27.

A steel chill of thickness about equal to that of the boss should cause the metal in the boss to freeze so quickly as to render the effect of the boss on the solidification front negligible, thus erasing the bumps shown in Fig. 26 and preventing cavity formation. Successive positions of the solidification front in this case would be as indicated in Fig. 27.

It will be noted that in Fig. 26, the solidification front in the early stages of freezing lies very close to the re-entrant corners of the casting, both at the boss and at the change of section D. A danger exists here, since atmospheric pressure acting on the outside of the casting may cause this thin skin to rupture at these points and a pipe running into the casting to form there. This danger can be avoided by properly radiusing to these corners, as indicated in Fig. 27.

Feeding Range a Factor — The number and location of the feeders to be used for the given casting must, of course, be consistent with their feeding ranges. Therefore, in considering the methods to be employed in feeding a given casting, it generally is desirable to divide the casting into a number of sections, each being fed by one feeder. Un-

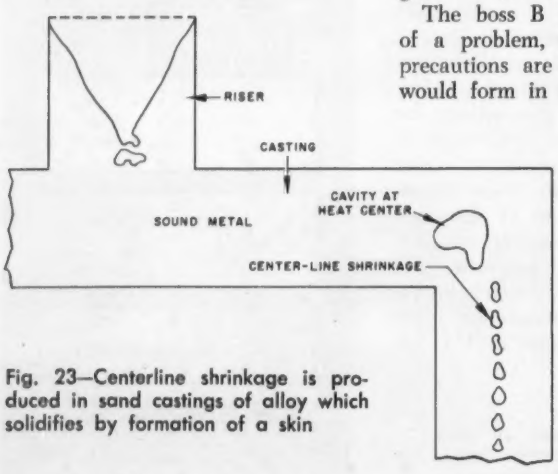


Fig. 23—Centerline shrinkage is produced in sand castings of alloy which solidifies by formation of a skin

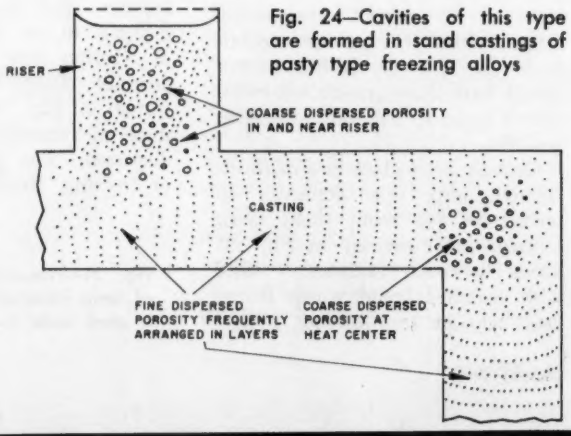


Fig. 24—Cavities of this type are formed in sand castings of pasty type freezing alloys

fortunately, feeding ranges in castings in copper alloys have not been investigated nearly as thoroughly as feeding ranges in steel castings. Indeed, apart from a small amount of work conducted by Pellini *et al.*,[11] very little work has been published.

The few experiments of Pellini suggest that feeding ranges in manganese bronze castings are rather longer than in the corresponding steel castings; for example, referring to plate casting, Bishop, Pellini, and Morey suggest that feeding ranges are about 5½ T, as opposed to 4½ T in a similar steel casting. The number of tests conducted was small, however, and it does not yet appear that feeding ranges in these alloys are fully established yet. For safety's sake it therefore probably is wise to use the rules developed for steel castings.[12]

Determining Riser Size—Various methods can be employed to determine the correct size of riser to use with castings and alloys of Group X. In the case of simple castings of chunky shape, an easy method is to make use of Chvorinov's rule, which states that the freezing time, t, of the casting is proportional to the square of the volume surface area ratio. Thus, $t = K \times (V/A)^2$ where K is a constant.

The V/A ratio of the casting is computed and that of the feeder is made such that the freezing time of the feeder is about 25 per cent greater than that of the casting, as indicated in the equation: $(V_r/A_r)^2 = 1.25\ (V_c/A_c)^2$; or $V_r/A_r = 1.12\ (V_c/A_c)$, the subscripts referring to riser and casting, respectively.

This method, although satisfactory with chunky castings, leads to feeders which are ridiculously large if applied to plates, bars, and other rangy castings, owing to the fact that Chvorinov's rule ignores edge effects which have a very considerable cooling effect in castings of this

Fig. 25 — Hypothetical casting used to illustrate the principles of feeding technique

description. With these castings, resort should be made to the methods developed by Caine or by Pellini and his colleagues for use with steel castings. Caine[13] defines a factor, F, the relative feeding time, as follows: $F = A_c/V_c \div A_r/V_r$. He also defines another factor, Z, which equals V_r/V_c, and suggests that these two factors are related by the following equation:

$$F = X \div (Z - B) + C$$

Caine indicates, without experimental evidence, that for brass, X and B are respectively equal to 0.04 and 0.017; for aluminum bronze and silicon bronze he quotes values of 0.24 and 0.017, respectively. The constant C is normally 1.0 for an open feeder.

Bishop, Myskowski, and Pellini[14] have presented for steel castings an empirical plot of V_r/V_c against an empirical shape factor defined as the length (L) plus the width (W) of the casting divided by its thickness (T)—that is, $(L + W)/T$ as shown in Fig. 28. The use of this plot to determine riser sizes works well with steel castings, and there is good reason to believe that it is also satisfactory with alloys of Group X. Numerous other authors also have advanced formulas for calculating sizes of risers for castings generally,[15] but it does not appear that the accuracy of these methods has been fully established.

Feeder Shape—No mention thus far has been made of the feeder shape. In general, the best combination of thermal efficiency and ease of molding would appear to be a cylinder with a height-to-diameter ratio in the range of 0.5-1.5. In smaller castings, it frequently is convenient to use blind feeders in the shape of a cylinder with a hemispherical cap and frequently a hemispherical bottom.

Satisfactory results often can be obtained by connecting these feeders to the casting via a short neck and gating into the casting through the feeder. Great care must be taken, however, if the blind feeders are at different levels since the possibility exists that one feeder may force metal into the other by virtue of hydrostatic action; this action naturally greatly reduces feeding effect and may give rise to severe shrinkage.

Exothermic materials frequently can be employed with advantage in feeding alloys of this group. Extremely high yields of the order of

TABLE III—Thickness of Moldable Exothermic

Riser Diam (in.)	Sleeve Wall Thickness (in.)
up to 2½	½
2½-6	¾
6-9	1
9-12	1¼
12-16	1½
16-24	2
24-30	2½

80 per cent or more may be obtained by this method, and it generally is sufficient to make the volume of the feeder equal to about 15 to 20 per cent of that of the casting and manganese bronze. Aluminum bronze may necessitate slightly larger feeders with volume 20 to 25 per cent of that of the casting. Exothermic feeders should have a height-to-diameter ratio of approximately 1.0 and the thickness of moldable exothermic used to surround the feeder should be as given in Table III.

To secure maximum feeding efficiency, the top surface of the metal in the feeder always should be covered with loose exothermic material

Fig. 26—Mode of freezing of the casting (Fig. 25) without special precaution to avoid shrinkage

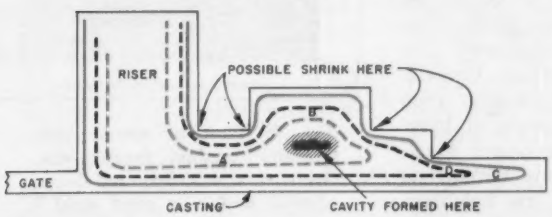
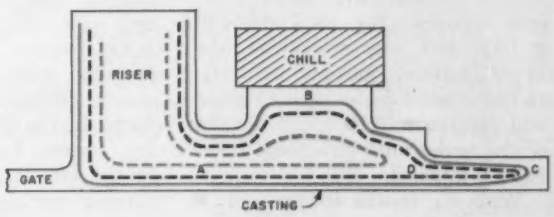


Fig. 27—Freezing mode of the casting when a chill is used and re-entrant corners are rounded



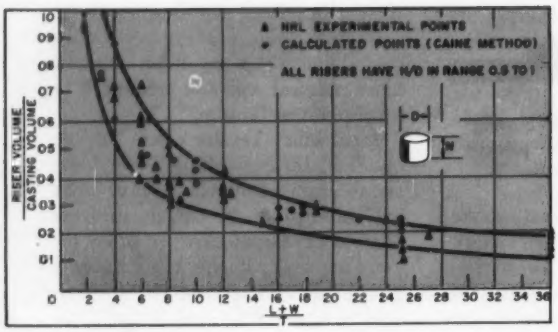

A NRL EXPERIMENTAL POINTS
• CALCULATED POINTS (CAINE METHOD)
ALL RISERS HAVE H/D IN RANGE 0.5 TO 1
RISER VOLUME / CASTING VOLUME
L+W

Fig. 28—A plot of the riser volume divided by casting volume against the casting length plus width divided by casting thickness[14]

immediately after casting. This procedure is important in using exothermic materials since heat losses by radiation from the exposed upper surfaces of feeders are considerable, especially when the sidewalls of the feeder are made of exothermic materials. In such cases, a much greater proportion of the total heat escapes from the upper surface if it is uncovered. This loss can be largely eliminated by use of an exothermic top cover of the kind discussed earlier.

Risering of Alloys of Group Y—Castings in alloys of this group pose something of a problem to foundrymen because they are extremely resistant to the most determined efforts to make them fully sound by directional freezing methods. Indeed, it is common experience that the average run of castings in these alloys contains 1 to 2 per cent of porosity, and it is exceedingly difficult to reduce the amount of porosity below about 1 per cent in all except small castings. In fact, attempts to reduce it more by increasing the size of the risers attached to the casting often are disastrous and actually decrease the soundness of the casting instead of increase it.

The difficulty of feeding castings and alloys of this group is well exemplified by the work of Jackson,[16] who experimented with a block 4 x 4 x 8 in. cast in red brass. Jackson first made this casting without any riser and found to his surprise that the casting was only moderately unsound, with about 3 per cent porosity (Fig. 29), although a large sink was evident on the upper surface. Jackson then attached a small feeder to the casting and progressively increased the size of this feeder until directional freezing was attained.

With the smaller feeders, only a slight decrease in the total porosity took place, as illustrated in Fig. 29, but the size of the sink decreased —that is, the volume of the casting increased. After the feeder had reached a certain size (insufficient to produce directional freezing), *visible* sinks on the surface of the casting were eliminated, as shown in Fig. 29. Further increase in the size of the casting caused a further increase in volume, although at this stage surface sinking was so slight as to be hardly noticeable. The interesting feature of Jackson's observations is that increasing the size of the feeder beyond that necessary to eliminate visible sinking actually causes porosity in the casting to increase again.

Little Effect on Soundness—Jackson therefore concluded that ordinary directional freezing does little to improve the soundness of sand castings in this alloy and that the main function of the feeder is to apply pressurization during the early stages of freezing, when the whole casting is in a mushy, semi-fluid state. It is assumed that during this period, compensation for freezing shrinkage takes place, at least in part, by mass feeding, as described by Baker for magnesium alloys.[17]

Mass feeding consists of movement of the pasty mass of liquid and solid and is a kind of compaction process analogous to the settling of a granular material such as sand in a drum which is vibrated. Mass feeding ceases when the casting becomes about 60 or 70 per cent solid, and, as the result of his work, Jackson has suggested that at this stage, feeding virtually ceases. Dispersed porosity then forms in the final stages of freezing. Support for this view is found in the fact that many commercial castings contain in the neighborhood of 1½ per cent porosity.

The subject of feeding in copper alloys of long-freezing range and in similar aluminum alloys has been studied by a number of researchers.[18-20] Work in connection with the closely similar aluminum alloys of long-freezing range has shown that to make castings (other than those of thin section) fully sound, directional freezing alone is not sufficient. Freezing also must exhibit steep temperature gradients towards the feeder.

Subsequent work on some of the alloys of Group Y by Johnson, Bishop, and Pellini[20] and later by Flinn and his associates,[21] working under the direction of the AFS Brass and Bronze Committee, has shown that this characteristic also is true of copper alloys of long-freezing range.

Both these groups of workers found that if temperature gradients during freezing of the casting were made steep—that is, if freezing was made strongly directional by means of chills covering virtually the entire surface of casting—high soundness resulted. If this procedure is adopted, the practice of risering becomes much the same as that described for alloys of Group X above. Pellini *et al.* and Flinn both recommend the use of tapered chills to obtain a sufficient degree of directional freezing in these alloys, as illustrated in Fig. 30. If a chill of this kind is applied to both sides of the section, it generally should be each about half the thickness of the section.

Chilling Used Rarely—The wholesale use of chills in this way unfortunately is uneconomic with

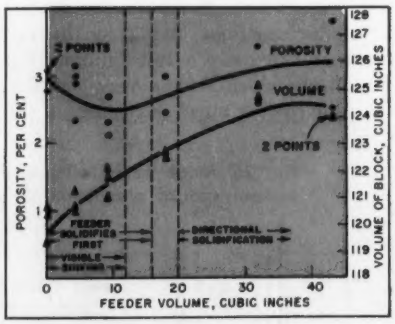


Fig. 29—Plots of volume and porosity against feeder size for a 4 x 4 x 8-in. red brass casting cast in a sand mold[16]

the majority of commercial castings of ordinary quality; for this reason the chilling technique is used only rarely. Instead, foundrymen consciously or unconsciously decide to tolerate 1 or 2 per cent of porosity. The problem then becomes one of seeking to distribute this porosity as uniformly as possible throughout the casting.

Fortunately, with the majority of bronzes, gunmetals, lead brass, etc., the presence of 1 or 2 per cent of well dispersed porosity does not render the casting unserviceable. Such castings usually are pressure-tested so that there is considerable justification for not seeking to eliminate the last 1 per cent or so of porosity.

If, then, it is desired not to eliminate porosity entirely but merely to distribute it uniformly, a different risering procedure has to be adopted, with the view to *avoiding directional freezing* and rather of making the casting freeze as *uniformly* as possible. To this end, the gates best are attached to the thinnest sections of the casting, thus retarding the freezing of these regions. The use of several gates may be an advantage because this practice spreads out the hot metal more uniformly. Risers should be used as sparingly as possible since their only purpose is to avoid the formation of surface sinks and internal local concentrations of porosity.

A good procedure to adopt is first to make the casting without any risers, then to attach small risers at points where surface sinks, leakage on pressure test, and similar defects are evident. The risers should be cylindrical, but with these alloys the height-to-diameter ratio should be at least 3:1. (Following his work, Jackson has suggested that the main purpose of feeders with commercial castings in these alloys is to supply gentle pressurization in the earlier stages of freezing and thus avoid the formation of surface sinks. Obviously pressurization will be greatest if relatively tall feeders are used since the hydrostatic pressure then is greater. Jackson has confirmed that the use of tall feeders gives some benefit.)

Trial and Error—It is difficult to specify the volume or diameter of the risers, and it may be necessary to find them by trial and error. The diameter normally should be no greater than is necessary to remove surface shrinkage defects. This requirement usually means that the diameter of the riser should not much exceed 1 to 1½ times the thickness of the casting section.

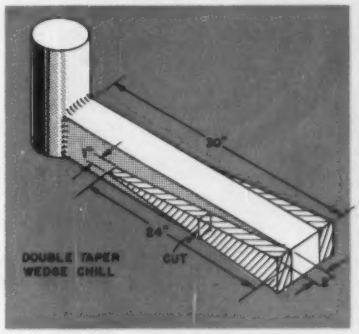


Fig. 30 — Wedge-shaped chills may be used to increase soundness of bronze castings

In small castings in alloys of Group Y, a common procedure is to make the gating system do the work of the riser, as described in the first section of this paper. When this technique is employed, a substantial sprue is used with diameter generally about the same as or even a little greater than the thickness of the casting section. The sprue is connected to the casting via a short, wide neck, as illustrated in Fig. 31. Frequently as an additional precaution, a shrink-bob is located in the neck, although this practice probably often is unnecessary. (As explained above, this practice constitutes poor gating procedure, and it is fortunate that red brass and other bronzes are insensitive to severe turbulence in the running system.)

With many castings, attempts to produce uniform freezing by the means described here are only partially satisfactory; in this event, a small gas content in the metal prior to pouring may be beneficial in avoiding locally heavy concentrations of porosity.[22] Small hydraulic castings such as valve bodies often can be made completely leaktight by increasing the phosphorus addition made immediately prior to pouring to a level above that needed to deoxidize the metal. This procedure promotes a controlled amount of metal-mold reaction which, as described by Baker and his colleagues,[22] causes the skin of the casting to be slightly porous, thus reducing the tendency for heavy concentrations of porosity to form in the heat centers of the casting.

Use of exothermic materials requires care with alloys of Group Y, for it is easy to upset the uniformity of solidification. When the uniform solidification technique is being employed, however, exothermic materials frequently are useful with the larger castings, which, in any case, have substantial risers attached to them. If exothermic materials are used with such castings, a tall, sticklike riser often gives all the pressurization necessary during the earlier stages of freezing.

If on the other hand it is desired to make the casting fully sound, exothermic materials are most valuable because they afford a ready means of steepening the temperature gradients during freezing, thus permitting smaller chills to be employed. In some instances, chills may be eliminated completely.

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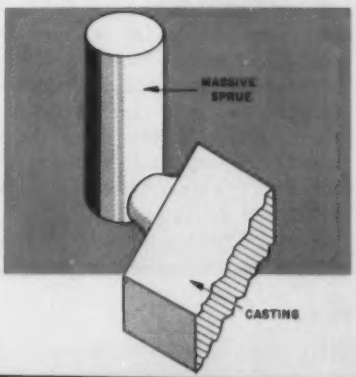
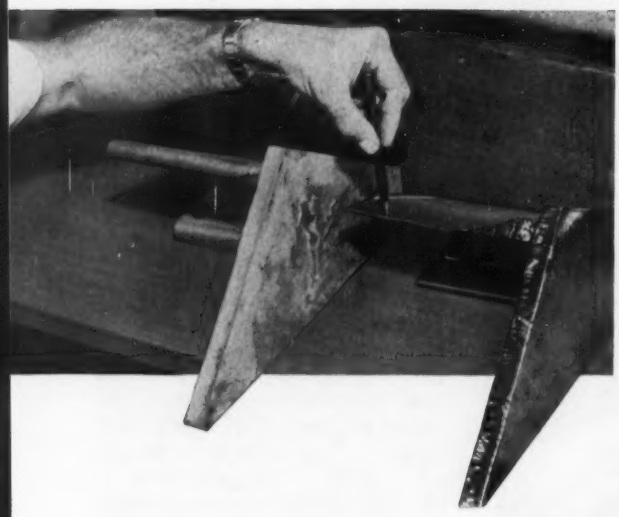
Fig. 31—A combined sprue and feeder frequently is employed in making bronze castings





Comparison of wear-resistant and mild steel bearing shields. The mild steel plate wore to a thin edge in two weeks, but the wear-resistant plate shows no wear at all after eight weeks of use

By GEORGE W. POWELL
Manager, Design Engineering
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New Developments in

BLAST CLEANING

Can new developments in blast cleaning help your company? Moderately small foundries have found that a new blast cleaning setup can save enough on labor costs alone to pay for itself very soon

● AUTOMATION is a magic word these days, and rightly so—if your foundry is big enough and your production warrants the substantial investment that fully automated processes often require.

But what about the little fellow? Have new developments in foundry equipment helped him?

The answer is *yes*—if he has taken advantage of them.

Consider blast cleaning, for example. Big, mechanized foundries have discovered that continuous-flow blast cleaning barrels can handle tons per hour of small and medium-sized castings with no operating manpower at all. Other high-production cleaning rooms use automated batteries of medium or large-sized batch barrels which measure out their own loads from castings coming to them on oscillating conveyors, blast clean them thoroughly, and send them on to following processes without even a pushbutton being pushed.

These mechanical marvels cost big, but justify their existence by savings which are considerably bigger.

If a foundry's production doesn't warrant a fully automated blast cleaning colossus, however, it still can get in on the new developments which make modern blast cleaning better, faster, and cheaper than ever before. Besides low-priced partial automation (which already has proved its ability to save more than its cost—in a hurry) several significant, although comparatively less dramatic, improvements now are available to give smaller foundries the benefit of modern technology in this field.

Automation vs Manhours—Let's stay with partial automation for the moment. Any foundry producing as much as 12,000 to 15,000 lb of castings a day can justify the cost of a new blast cleaning batch barrel like the one being used by Buckeye Iron & Brass Works, Dayton, Ohio, which produces 12,000 to 15,000 lb of castings a day.

Buckeye Iron & Brass had a blast cleaning barrel still in good serviceable condition. To cut costs, the company purchased a new 6-cu ft barrel with automation features. This equipment requires no assigned operator. The man handling the preceding operation (immediately adjacent to the barrel) loads the skip, touches a button, and gets right back to his regular job. Everything else is automatic: As the work conveyor starts moving, the loader dumps its castings into the blast compartment, the abrasive-tight door closes, and the blast action begins. After a preset time, blast action shuts off, the work conveyor tumbles work a short time to remove abrasive, the door opens, and the work conveyor reverses to discharge the cleaned castings into the waiting tote box. The man at the following operation removes the castings. All this occurs in less than 5 minutes.

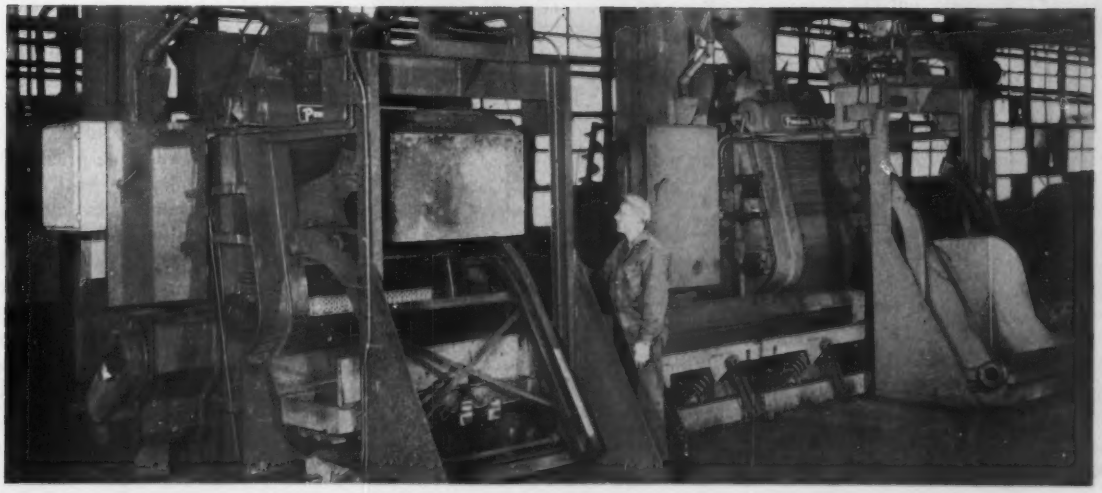
The new cleaning setup will save this moderately small company enough on labor costs alone to pay for the new equipment in a short time. There are other, substantial savings as well. For example, blast

time per load has been cut from 15 to 4½ minutes. Maintenance costs are extremely low—a fraction of what it cost to keep the previous barrel in operating condition. The first set of wheel vanes lasted 170 hours actual blast time before replacement. After seven months operation, the end liners showed no signs of wear at all. The old machine in the same length of time would have required welding on new end plates at least twice, the company says.

Paul Gray, foundry superintendent at Buckeye states, "A lot of companies still won't consider new cleaning room equipment so long as their present machines are still serviceable. But they are missing the whole idea. Tools are designed to cut production costs. When a *new* tool will do the job enough faster and cheaper to pay for itself and make an extra profit as well, you are wasting company funds if you keep on using the outmoded machine."

More Horsepower Gives Lower Costs—Even without automation, new blast cleaning equipment boasts features which obsolete the best shot blast machines built only a few years ago. One of the most significant improvements is higher

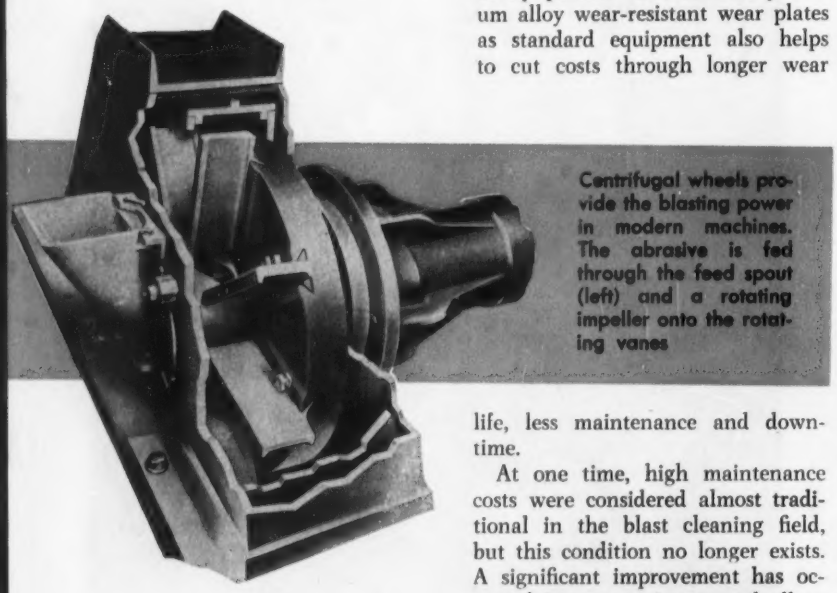
After preset cleaning cycle, machine shuts off, the door opens, and conveyor reverses to discharge castings to the oscillating conveyor



One operator, part-time, works two 12-cu-ft blast cleaning barrels. He loads the skip, pushes the button, then goes back to his other work

wheel horsepowers, which throw more abrasive and blast clean more work in fewer manhours. Some of these new machines have double the horsepower of equipment purchased only recently. This feature alone can cut small foundry cleaning time and costs almost in half.

A good example is a new, heavy-duty line of barrels which—depending on the size of the machine—now employ wheel horsepowers ranging from 30 to 75. The largest barrel in the series is available with two blast wheels which use 75-hp motors to throw 100 tons of abrasive per hour. Even the relatively small 15-cu-ft barrel has a wheel which throws 50,000 lb of abrasive per hour. Although not yet used on blast barrels, 100-hp wheels are available for other special blast cleaning applications.



Centrifugal wheels provide the blasting power in modern machines. The abrasive is fed through the feed spout (left) and a rotating impeller onto the rotating vanes

Only two years ago the tableroom type of cleaning machine, the all-around workhorse of the jobbing foundry, used 20-hp motors to throw 32,000 lb of abrasive per hour. Now the popular 6-cu-ft size uses 30 hp to throw 50,000 lb. The 8-cu-ft size uses two 30-hp blast units to throw 100,000 lb, or 50 tons, of abrasive per hour.

Improvements in the abrasive impeller feeding parts of centrifugal wheels constituted the breakthrough to modern blast cleaning speeds. Today shot blast units which operate at a high capacity use this new improved impeller design which makes possible increased abrasive flow.

Another factor is the equally important improvement in the efficiency and capacity of abrasive cleaning and recycling systems. The centrifugal wheel units cannot, of course, throw abrasive at a sustained rate faster than it is supplied.

Less Maintenance—Another major reason for improved efficiency and lower operating costs of blast cleaning equipment is heavier construction where it counts. Heavier construction cuts maintenance costs to record-breaking lows for this kind of equipment. Use of more premium alloy wear-resistant wear plates as standard equipment also helps to cut costs through longer wear life, less maintenance and downtime.

At one time, high maintenance costs were considered almost traditional in the blast cleaning field, but this condition no longer exists. A significant improvement has occurred in wear-resistant steel alloys which have proved their ability to last 100 times as long as mild steel. The cost-cutting results have been spectacular in some instances. Companies which switched to these premium alloys two or three years ago still haven't worn out their wear-resistant alloys. Consequently, final savings figures still are not available.

In addition to significant savings on the cost of the wear plates themselves, you also must consider the economies resulting from reduced shipping costs, virtual elimination of downtime for plate changing, and drastic reduction of maintenance labor.

You get some idea of the savings from statements like these:

"We used to get 80-hr life from a mild steel cover. We stopped checking when the same part in wear-resistant alloy passed 4300 hours."

"Our wear-resistant alloy has outworn mild steel 63 to 1 so far."

"We'll save, too, on parts investment. We used to stock in lots of 40; now we'll need only one."

"Invested $400—saved $2500 the first 18 months."

"13,135 hours on the blast cleaning machine and we haven't changed a liner yet."

With the new higher horsepower wheels throwing more abrasive per unit of time than ever before, the wear-resistant type of wear plates is more important today than at any time previously.

Improved Steel Abrasives — Another significant development which can lead to substantially lower blast cleaning costs concerns steel shot and grit. Steel abrasives as such are noteworthy improvements over the former chilled iron and malleable iron types, and in the last year or two significant improvements both in shotting methods and heat treating techniques have made steel abrasives better than ever before.

As steel shot and grit have improved, designers of blast cleaning equipment have succeeded in developing truly abrasive-tight machines which make the premium quality steel materials more economical to use in every instance where abrasive carryout can be controlled. Today any foundry, regardless of size, which employs a modern blast cleaning machine can save money by switching to the new, tough, durable steel abrasives. They not only last substantially longer, but usually clean faster and are easier on the blast cleaning equipment.

Buyers of castings care little about the problems of individual foundries. They are interested only in locating dependable sources of good quality, properly finished castings at good competitive prices. As a result, no foundry can justify high prices or poor quality by pleading small size or limited equipment. To stay in business and make a profit these days, even small foundries must take advantage of new developments to speed production, improve their quality, and cut costs.

The cleaning room, it would seem, is a good place to start.

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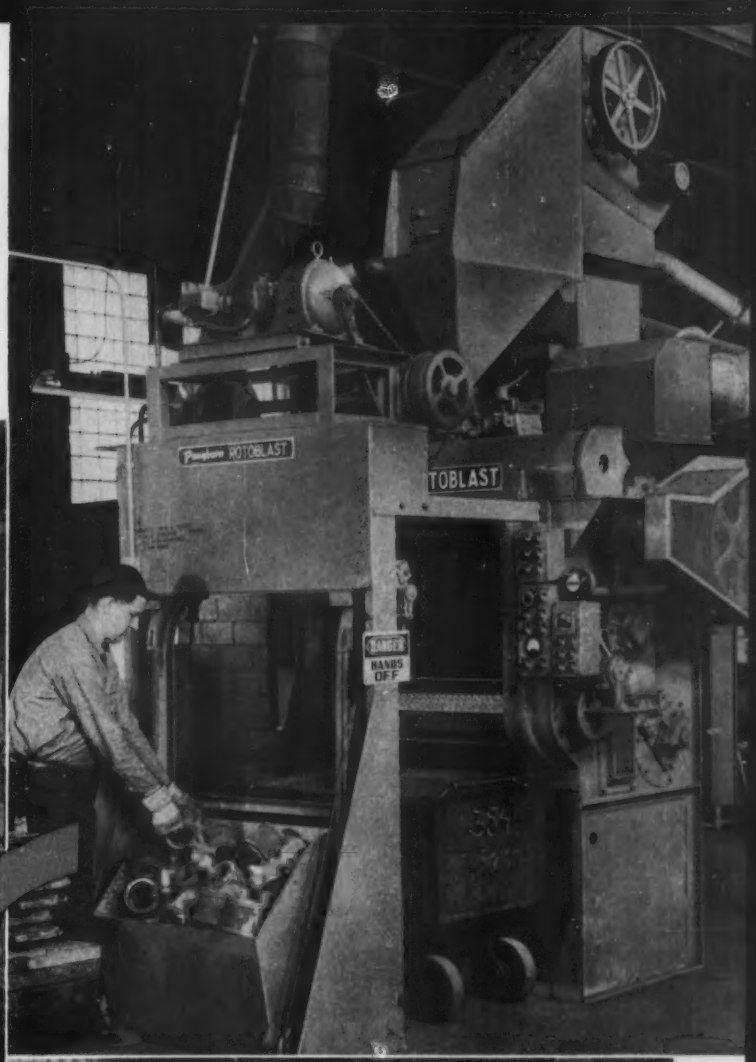
This equipment requires no assigned operator. Worker from an adjacent station loads castings into the skip



When castings are cleaned, machine automatically shuts off, opens, and discharges its load. Worker at the following operation removes the castings

Castings shown before and after blast cleaning operation in modern automated blast equipment

How Aluminum Foundries

Estimate Casting Weights

Casting weight is an important cost factor in preparing a quotation for a customer. Three common methods are used to determine weight of a casting. One involves weighing a sample of the cast part or its pattern. The others employ a planimeter or simple mathematical formulas to estimate weight from blueprints

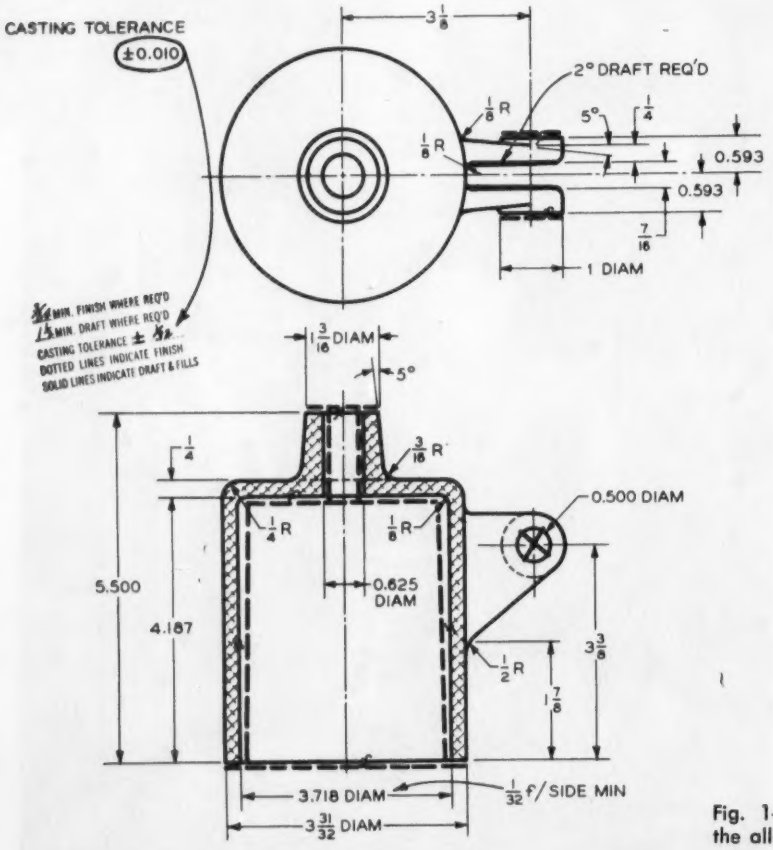


Fig. 1—Typical drawing marked to indicate the allowances for finish and draft

● SINCE one of the most important factors entering into the cost of an aluminum casting is its weight, an accurate determination of the weight must be made before a foundry can give a sound quotation to the purchaser.

When a sample of the part or a loose wood pattern is available, weight determination is a simple matter. If the sample is aluminum and its dimensions correspond to those shown on the print, it need only be weighed on an accurate scale. If the sample is of another metal, its weight in aluminum can easily be computed by applying a suitable factor (Table I) to the weight of the sample. The same procedure can be applied to a loose wood pattern of the part.

If the casting is to have any finished surfaces, allowances must be made for the cast metal removed during machining operations, as explained later. If there are any "fills," where metal is to be added,

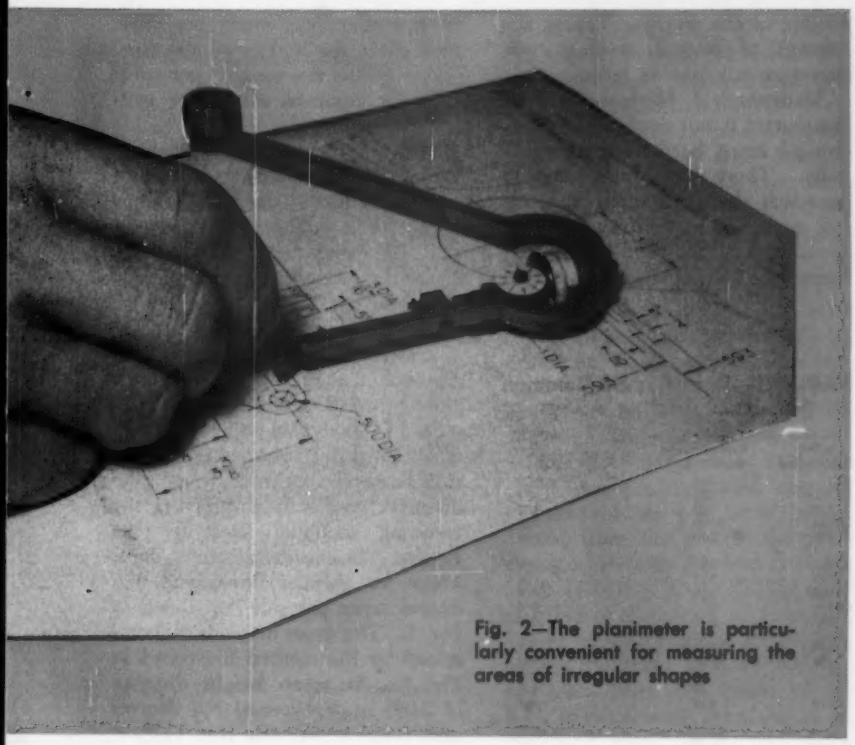


Fig. 2—The planimeter is particularly convenient for measuring the areas of irregular shapes

TABLE I—Densities of Cast Metals and Pattern Materials

Material	Lb per Cu In.	Relative Weight Factor
Aluminum	0.098	1.00
Copper	.324	3.31
Bronze	.320	3.26
Iron, gray	.260	2.65
Magnesium	.063	0.64
Steel	.284	2.90
Titanium	.165	1.68
Zinc	.260	2.65
Mahogany	0.0202-0.0306	0.206-0.312
Pine, white	0.0145	0.148

modeling clay may be added to the sample or pattern as required, then reformed into a geometric figure and scaled to find its volume; when multiplied by the weight of aluminum per cubic inch this volume will give the added weight for the fills.

Using the Blueprint—When neither sample nor pattern is available, the estimated weight must be determined from the print. First, however, the print is marked to indicate finish and draft allowances. Where finished surfaces are specified, additional metal must be cast to assure the purchaser that a smooth surface will be obtained when the casting is machined to dimensions which are specified.

Draft, or taper, on certain surfaces is necessary to enable the pattern to be withdrawn from the mold in the case of sand castings or to enable the casting to be removed from the mold in the case of permanent-mold castings.

Fig. 1 shows a typical print marked to indicate allowances for finish and draft. Finish allowances are indicated by a dashed line and draft by a solid line. The two small holes in the arm of the casting are not practical to cast, and these are marked so that the amount of metal to be cast will be estimated accordingly.

When marking the print for finish and draft allowances, the casting tolerances on which the quotation is based also are usually marked, especially if they deviate from the requested tolerances. Marking the print in this manner leaves no question as to how the part is quoted, which often saves time in correspondence between purchaser and foundry.

The Planimeter—There are two common methods of estimating

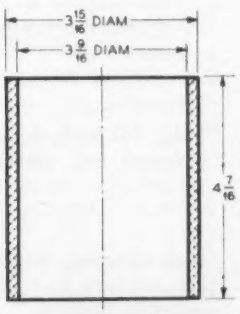


Figure 3a

3.937 Diam Area − 3.562 Diam Area × 4.437 = (12.174 − 9.965) × 4.437 = 9.80 Cu In. = 9.8 Cu In.

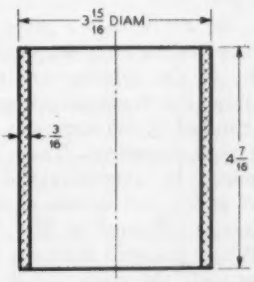


Figure 3b

0.187 × (3.937 − 0.187) π × 4.437 = 0.187 × 3.750 π × 4.437 = 9.78 Cu In. = 9.8 Cu In.

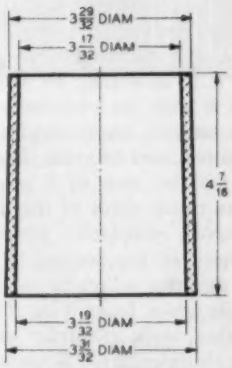


Figure 3c

$$\frac{3.968 \text{ Diam} + 3.906 \text{ Diam}}{2} = \text{Mean OD of } 3.937$$

$$\frac{3.532 \text{ Diam} + 3.594 \text{ Diam}}{2} = \text{Mean ID of } 3.563$$

Fig. 3—Use of mathematical methods to determine area of a casting

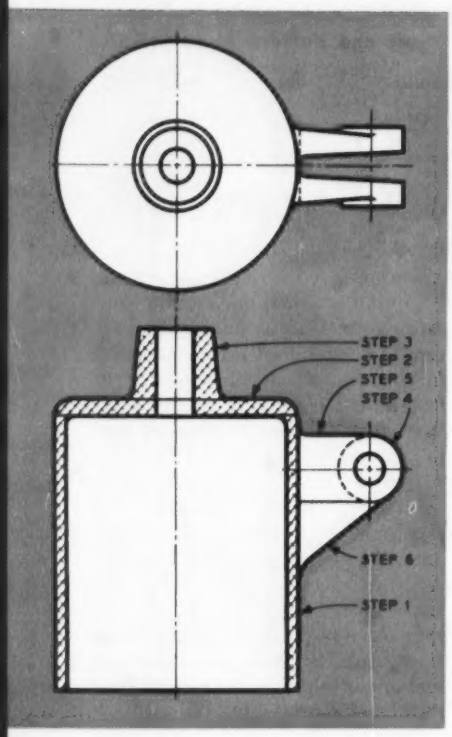


Fig. 4—Breakdown of casting of Fig. 1 into geometric shapes

weights of castings from prints. The first, and by far the simpler, involves the use of the planimeter; the second, calculations by means of simple and well known formulas. With either method, the volume of the casting is first determined, and this is then multiplied by the weight of aluminum per unit volume.

In using the planimeter, which is a device for measuring areas, the print must first be checked to be sure that it is accurately to scale. If it is not to scale, an accurate layout of the sections whose areas are to be measured must be made. Then to determine the area of a given section, the tracer point of the device is moved completely around the periphery of the section in a clockwise direction (Fig. 2). One dial records areas from 0 to 9.99 square inches, with a vernier registering in hundredths. A second dial indicates areas from 10 to 100 square inches.

The planimeter is particularly useful in measuring the areas of irregular shapes. Its accuracy is as close as the operator can follow the outline of the section. Taking the average of several readings will minimize any tracing errors.

Mathematical Methods — If a planimeter is not available, the entire job must be done mathematically. There are several ways to approach the calculations, depending on the way the drawing is dimensioned or upon individual preferences.

TABLE II—Densities of Common Aluminum Casting Alloys

ALLOY		WEIGHT
ASTM Designation	Commercial Designation	Lb per Cu In.
C4A	195	0.102
CG100A	122	.107
CN42A	142	.102
CS42A	B195	.101
CS43A	108	.101
CS66A	152	.104
CS72A	113	.106
CS104A	138	.107
G4A	214	.096
G10A	220	.093
GS42A	B214	.096
GZ42A	A214	.097
S5A	43	.097
S5B	43	.097
SC51A	355	.098
—	C355*	.098
SC64A	A108	.101
SC64B	319	.101
SC64C	319	.101
SC82A	327	.098
SC103A	—	.100
SC122A	B132	.098
SG70A	356	.097
—	A356*	.097
SN122A	A132	.098
ZC60A	C612	.103
ZC81A	Tenzaloy	.100
ZC81B	Tenzaloy	.100
ZG32A	Ternalloy 5	.100
ZG42A	Ternalloy 7	.100
ZG61A	40E	.101
ZG61B	A612	.102

*C355 and A356 are new alloys not covered in ASTM specifications. They are lower-iron modifications of 355 and 356, respectively.

For example, a simple bushing or cylinder can be figured in two different ways as shown in Fig. 3a and 3b, but with the same result. Where draft is involved, so that the walls of the cylinder are tapered slightly, the computation can still be handled in the same way by using mean diameters. These are determined by averaging the diameters at top and bottom of the cylinder, as indicated in Fig. 3c.

Where the wall thickness is uniform, only the mean outside diameter need be determined if the method shown in Fig. 3b is used. Where the wall is tapered, either method may be used, but with the method of Fig. 3b the mean wall thickness must first be determined.

Whichever method is used, multiplying the volume by the weight of the alloy in pounds per cubic inch gives the weight of the part. Table II lists the weights per cubic inch for common aluminum casting alloys.

Parts that are not in themselves simple geometric sections must first be broken down into such sections before their volumes can conveniently be computed. To illustrate how the weight of the casting shown in Fig. 1 may be determined, the part is first broken down as illustrated in Fig. 4. Computation of the volumes of the various parts then proceeds as follows:

Step 1—Body: Volume of the body is obtained by subtracting the inside-diameter area from the outside-diameter area and multiplying the resulting sectional area by the height. The inside diameter must allow for $\frac{1}{32}$-inch finish and $1\frac{1}{2}$ degree taper per side, as shown in Fig. 1. The mean diameter is determined by the method illustrated in Fig. 3c. At mean height distance of 2.093 in., a taper of $1\frac{1}{2}$ degrees adds 0.055 in. per side (tan $1\frac{1}{2}° \times 2.093$). This added to the $\frac{1}{32}$-in.

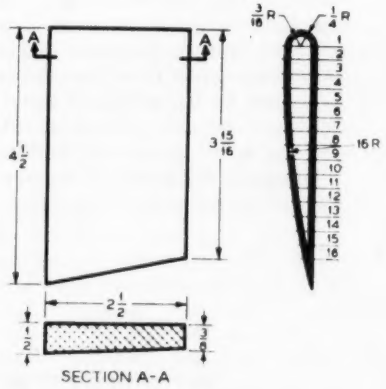


Fig. 5—Blade-shaped section divided into geometric shapes

finish allowance totals 0.086 in. per side, resulting in a mean inside diameter of 3.546 in.

The volume of the body thus is: (Area of $3\frac{3}{32}$ diam − Area of 3.546 diam) × 4.187 = (12.366 − 9.876) × 4.187 = 10.42 cu. in.

Step 2—Top: Disregarding for the present the 0.625-in hole at its center, the top section is simply a circular disk and its volume is: Area

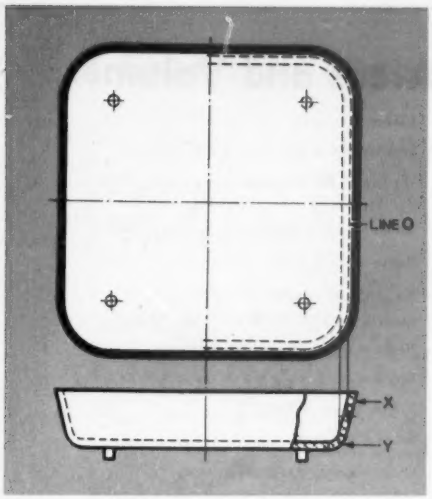


Fig. 6—Breakdown of fry pan into geometric shapes

of $3\frac{3}{32}$ diam × ($\frac{1}{4}$ + finish) = 12.366 × 0.296 = 3.66 cu in.

Since the 0.625-in. hole extends through two sections, its volume can more easily be computed in one step and deducted at the end.

Step 3—Top Boss: To compute the volume of the top boss it is first necessary to determine the mean outside diameter. This would be at a point midway between the top of the top section and the top of the boss, allowing for $\frac{3}{64}$-in. finish at the top (see Fig. 1). By simple arithmetic this point is found to be 0.554 in. below the top of the boss. Multiplying this distance by the tangent of 5 degrees gives the increase in mean radius over top radius. Thus the top diameter is increased by tan 5° × 0.554 × 2 (both sides) = 0.096 in., making the mean outside diameter 1.283 in. Again disregarding the 0.625 inch hole, the volume of the boss thus is:

Area of 1.283 diam × (1.063 plus finish on top) = 1.293 × 1.109 = 1.433 cu in.

Step 4—Bosses on Side Arms: Since the holes in the side arms are not to be cast, the two bosses are computed solid with no deduction for the holes. The bosses thus are simply two cylindrical sections and their volume is: Area of 1 diam × (thickness + finish) × 2 bosses = 0.7854 × 0.421 × 2 = 0.661 cu in.

Steps 5 and 6—Side Arms: The volume of each arm can be determined by multiplying the area of the arm by its mean thickness. Here is a case where the planimeter provides the simplest means of determining the area. If one is not available, however, the arms may be broken down into two geometric sections as shown in Fig. 4 and the volumes of these sections determined separately.

Taking first the rectangular portion (Step 5) the width is the same as the diameter of the boss, or 1 in. From Fig. 1, the length from center line of the boss to the body is: $3\frac{1}{8}$ (center to center) − ½ of $3\frac{1}{32}$ diam = 3.125 − 1.984 = 1.141 in.

Since the volume of the bosses already has been computed, one-half the area of the boss must be deducted from the rectangular area, giving a net area for Step 5 as follows: (1.141 × 1) − 0.7854 ÷ 2 = 0.748 sq in.

The mean thickness of the rib, or the thickness midway between the main body and center of the boss, is determined from the ¼-in. dimension shown at the end of the arm in Fig. 1, the 5 degree taper on the outside and the 2 degree taper on the inside. The midpoint of the arm, of course, is half its length or 1.141/2 = 0.570 in. The increase in thickness at this point due to taper is: (0.570 × tan 5°) + (0.570 × tan 2°) = 0.072 in.

The mean thickness of the arm thus is ¼ + 0.072 = 0.322 in. The volume of the top portion of the two arms then is 0.748 × 0.322 × 2 ribs = 0.482 cu in.

The volume of the triangular portion of the side arms (Step 6) may be computed by the same general method. The area of the triangle, or course, is equal to ½ its base dimension multiplied by its vertical dimension. The base dimension is 1.141 + $\frac{3}{16}$ inches (by scale from scale drawing) = 1.328 in. From Fig. 1, the vertical dimension is 1 in. The area thus is ½ × 1.328 × 1 = 0.664 sq in.

As in Step 5, the mean thickness of this section is obtained from the ¼-in. dimension at the outer edge, the outside taper of 5 degrees and inside taper of 2 degrees; but in this case the thickness is computed at the center of gravity of the triangular area which is at a point $\frac{2}{3}$ of the distance from the outer corner or $\frac{2}{3}$ × 1.328 = 0.88 in. As above, the increase in thickness at this point due to taper is: (0.88 × tan 5°) + (0.88 × tan 2°) = 0.106 in.

The mean thickness of the triangular portion of the arm thus is ¼ + 0.106 = 0.356 in. The volume of the triangular portion of the two arms then is 0.664 × 0.356 × 2 arms = 0.473 cu in.

The volume of the casting, of course, is obtained simply by totaling the volumes of the various sections:

Body (Step 1)	10.42
Top (Step 2)	3.66
Top boss (Step 3)	1.433
Bosses on side arms (Step 4)	.661
Side arms (Step 5)	.482
(Step 6)	.473
Total	17.129 cu in.

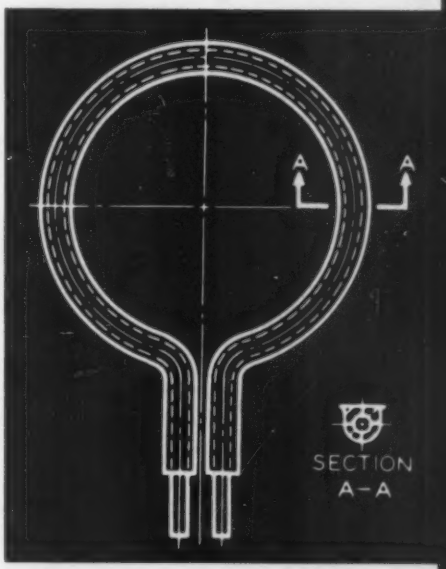


Fig. 7—Heating element of the fry pan illustrated in Fig. 6

A deduction must now be made for the 0.625-in. hole at the top of the part. The mean diameter of the hole, or the diameter at its midpoint, must first be determined. From Fig. 1, the total length of the hole with machining allowances at top and bottom is: 5.500 − 4.187 + (2 × $\frac{3}{64}$) = 1.407 in.

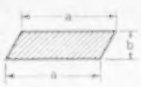
The midpoint of the hole is thus half this distance from top or bot-

Table III — Formulas for Calculating Areas and Volumes

Rectangle and Parallelogram

Area = ab

Center of gravity is at intersection of diagonals

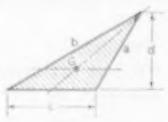


Triangle

Area = $\frac{1}{2}\,cd$

Area = $\sqrt{s\,(s-a)\,(s-b)\,(s-c)}$ where $s = \frac{1}{2}\,(a+b+c)$

Center of gravity is at intersection of medians, G. Perpendicular distance from base = $\frac{d}{3}$



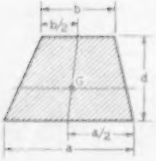
Regular Polygons

n = number of sides, s = length of one side, r = inside radius

Area = $\frac{1}{2}\,nsr$

Number of Sides	Area
5	$1.72047\,s^2 = 3.63273\,r^2$
6	$2.59809\,s^2 = 3.46408\,r^2$
7	$3.63395\,s^2 = 3.37099\,r^2$
8	$4.82847\,s^2 = 3.31368\,r^2$
9	$6.18181\,s^2 = 3.27574\,r^2$
10	$7.69416\,s^2 = 3.24922\,r^2$
11	$9.36570\,s^2 = 3.22987\,r^2$
12	$11.19616\,s^2 = 3.21539\,r^2$

Center of gravity is at geometric center

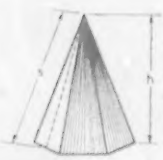


Trapezoid

Area = $\frac{d(a+b)}{2}$

Center of gravity is at G.

Perpendicular distance from base = $\frac{d(a+2b)}{3(a+b)}$



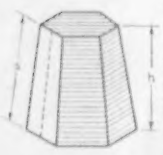
Pyramid

A = area of base

P = perimeter of base

Lateral area = $\frac{1}{2}\,Ps$

Volume = $\frac{1}{3}\,Ah$



Frustum of Pyramid

A = area of base

a = area of top

m = area of midsection

P = perimeter of base

p = perimeter of top

Lateral area = $\frac{1}{2}\,s\,(P+p)$

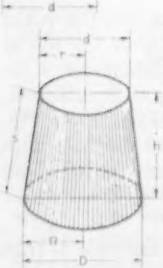
Volume = $\frac{1}{3}\,h\,(a + A + \sqrt{aA})$

Volume = $\frac{1}{6}\,h\,(A + a + 4\,m)$

Cone

Conical area = $\pi rs = \pi r\sqrt{r^2+h^2}$

Volume = $\frac{1}{3}\,\pi r^2 h = 1.0472\,r^2 h = 0.2618\,d^2 h$



Frustum of Cone

A = area of base

a = area of top

m = area of midsection

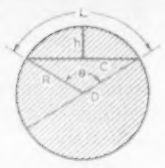
$R = D + 2$; $r = d + 2$

Area of conical surface = $\frac{1}{2}\,\pi s\,(D+d) = 1.5708\,s\,(D+d)$

Volume = $\frac{1}{3}\,h(R^2 + Rr + r^2) = 1.0472\,h(R^2 + Rr + r^2)$

Volume = $\frac{1}{12}h(D^2 + Dd + d^2) = 0.2618h(D^2 + Dd + d^2)$

Volume = $\frac{1}{24}\,h(a + A + \sqrt{aA}) = \frac{1}{6}\,h(a + A + 4\,m)$



Circle

Circumference = $\pi D = 2\,\pi R = 2\sqrt{\pi \times \text{Area}}$

Diameter = $2\,R$ = circumference $\div\,\pi = 2\sqrt{\frac{\text{Area}}{\pi}}$

Radius = $\frac{1}{2}\,D$ = circumference $\div\,2\,\pi = \sqrt{\frac{\text{Area}}{\pi}}$

Radius = $\frac{(C/2)^2 + h^2}{2\,h}$

Area = $\frac{1}{4}\,\pi D^2 = 0.7854\,D^2 = \pi R^2$

Chord = $2\sqrt{h\,(D-h)} = 2\,R \times \sin\frac{1}{2}\,\theta$

Height of arc, $h = R - \sqrt{R^2 - (C/2)^2}$

Length of arc, $L = \frac{\theta}{360} \times 2\,\pi R = 0.0174533\,R\theta$

$\frac{1}{2}\,\theta$ (in degrees) = $28.6479\,\frac{L}{R}$

Sin $\frac{1}{2}\,\theta = \frac{C}{2} \div R$

Center of gravity is at geometric center

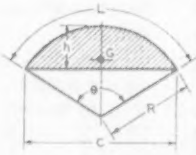
Sector of Circle

Area = $\frac{1}{2}\,LR$

Area = $\pi R^2 \times \frac{\theta}{360} = 0.0087266\,R^2\theta$

Center of gravity is on axis of symmetry at G.

Distance from center = $\frac{2R \sin \theta/2}{0.02618\,\theta}$



Segment of Circle

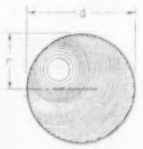
Area = $\pi R^2 \times \frac{\theta}{360} - \frac{C\,(R-h)}{2}$

Length of arc $L = 0.0174533\,R\theta$

Area = $\frac{1}{2}\,[\,LR - C\,(R-h)\,]$

Center of gravity is on axis of symmetry at G.

Distance from center = $\frac{2R^2 \sin^3 \theta/2}{3A} = \frac{C^3}{12A}$

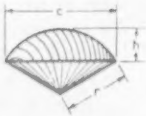


Sphere

Surface = $4\,\pi r^2 = 12.5664\,r^2 = \pi d^2$

Volume = $\frac{4}{3}\,\pi r^3 = 4.1888\,r^3$

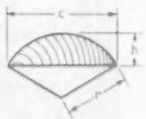
Volume = $\frac{1}{6}\,\pi d^3 = 0.5236\,d^3$



Sector of Sphere

Total surface = $\frac{1}{2}\,\pi r\,(4\,h + c) = 1.5708\,r\,(4\,h + c)$

Volume = $\frac{2}{3}\,\pi r^2 h = 2.0944\,r^2 h$



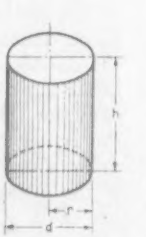
Segment of Sphere

Spherical surface = $2\,\pi rh = \frac{1}{4}\,\pi\,(c^2 + 4\,h^2) = 0.7854\,(c^2 + 4\,h^2)$

Total surface = $\frac{1}{4}\,\pi\,(c^2 + 8\,rh) = 0.7854\,(c^2 + 8\,rh)$

Volume = $\frac{1}{3}\,\pi h^2\,(3\,r - h) = 1.0472\,h^2\,(3\,r - h)$

Volume = $\frac{1}{24}\,\pi h\,(3\,c^2 + 4\,h^2) = 0.1309\,h\,(3\,c^2 + 4\,h^2)$



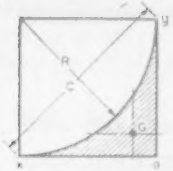
Cylinder

Cylindrical surface = $\pi dh = 2\,\pi rh = 6.2832\,rh$

Total surface = $2\,\pi r\,(r + h) = 6.2832\,(r + h)$

Volume = $\pi r^2 h = \frac{1}{4}\,\pi d^2 h = 0.7854\,d^2 h$

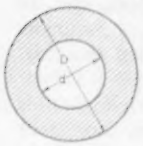
of Geometric Shapes



Fillet

Area = $0.2146\ R^2 = 0.1073\ C^2$

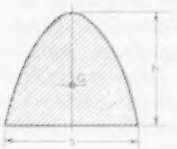
Center of gravity is at G. Distance from ox and oy = $\frac{10 - 3\pi}{3(4 - \pi)}\ R = 0.223\ R$



Circular Ring

Area = $0.7854\ (D^2 - d^2)$, or $0.7854\ (D - d)\ (D + d)$

Center of gravity is at geometric center

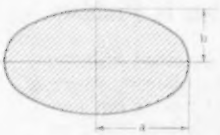


Parabolic Segment

Area = $\frac{2}{3}\ ab$

Center of gravity is on axis of symmetry at G.

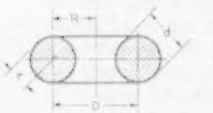
Distance below top = $\frac{3h}{5}$



Ellipse

Area = $\pi\ ab = 3.1416\ ab$

Center of gravity is at geometric center



Ring of Circular Cross Section

Area of surface = $4\pi^2\ Rr = 39.4784\ Rr$

Area of surface = $\pi^2\ Dd = 9.8696\ Dd$

Volume = $2\ \pi^2\ Rr^2 = 19.7392\ Rr^2$

Volume = $\frac{1}{4}\ \pi^2\ Dd^2 = 2.4674\ Dd^2$

tom, or 0.704 in. Deducting for a finish allowance of $\frac{1}{32}$ inch and for 1½-degree draft on each side, the diameter of the hole at midpoint is: $0.625 - (2 \times \frac{1}{32}) - (\tan 1\frac{1}{2}° \times 0.704 \times 2) = 0.526$ in.

The volume of the hole as cast then is: Area of 0.526 diam × 1.407 = 0.217 × 1.407 = 0.306 cu in.

Deducting this from the total volume of 17.129 gives a net volume of 16.823 cu in. for the casting.

As indicated in Table II, the density of aluminum casting alloys varies from 0.093 to 0.107 lb per cu in., depending on the alloy. If the casting were made from an alloy that weighed 0.098 lb per cu in., its weight would be 0.098 × 16.823 or 1.649 lb.

Where greater accuracy is required in estimating weights, allowances would need to be made for fillets. In many small castings, the error introduced by ignoring the fillets would not be significant. In computing the weights of larger parts, however, it may be desirable to take all fillet areas into account. A formula for computing fillet areas is given in Table III. Some foundries compute weights without allowances for either tolerances or fillets, then add 5 per cent to cover both.

Other Examples — In computing the weight of the blade-shaped part shown in Fig. 5, the use of a planimeter is strongly recommended. However, the part may be divided into sections as shown and the volumes of the various sections computed by means of well known formulas. First a scale drawing of the part is prepared so that measurements of the various sections may be scaled directly.

To compute the volume of Section 1 the mean cross-sectional area must be determined at midpoint between front and back of the blade. As may be seen from the drawing, the mean diameter of this semicircular area is ½ × (½ + ⅜) or $\frac{7}{16}$ in. The volume of Section 1 thus is:

½ (Area of $\frac{7}{16}$ diam) × 2½.

For Section 2, which is rectangular, the volume is $\frac{7}{16}$ (the mean width) × ¼ × 2½. This procedure is carried out for all of the remaining sections to obtain the total volume of the casting. If the planimeter were used, it would be necessary only to measure the mean area of the end view and multiply this by 2½, the width of the casting.

Fig. 6 and 7 show how a fry pan may be broken down into two major parts for figuring the weight. In Fig. 6, the volume of the sides is determined by computing area X and multiplying this by the periphery of line O which represents the center of gravity of the area. The length of the periphery may be determined by stepping it off on a scale drawing with dividers set at a convenient dimension, say ½ or 1 inch, or by means of a map measurer.

Similarly, the corner area Y is multiplied by the periphery of the line indicating its center of gravity, the periphery again being stepped off with dividers or determined by a map measurer. The remainder of the pan consists of regular geometric shapes whose volumes can easily be computed by using the appropriate formulas.

The volume of metal in the heating-element backing illustrated in Fig. 7 may be computed in the same manner as the volume of the corner section of the pan. In other words, the area of Section AA is multiplied by the distance along the center line which, as before, is determined by stepping off on a scale drawing with dividers or by means of a map measurer.

With a little ingenuity, almost any casting can be divided into a series of common geometric shapes in the manner illustrated here. Then through the use of formulas such as those given in Table III and the weight figures given in Table II the weight of a casting is readily computed.

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Questions and Answers

Copper chaplets do not fuse easily . . . Some features are common to stack and multiple molding practices . . . Slag causes some trouble . . . Plaster is not suitable for iron . . . Cupola design . . . Veins form

Has Problem with Chaplets

We are making some pure copper castings containing cores which require chaplets to hold them in place. Castings must be water-tight, and we would like to know if there is any material which will melt on contact with the molten metal without contaminating the copper.

Probably the only material that could be used for chaplets in copper castings which would melt and not change the metal composition would be copper. We suspect that you have tried copper chaplets but find that they do not fuse sufficiently to eliminate leakage since copper has a high thermal conductivity. Perhaps you can overcome the trouble by using chaplets of the smallest possible cross section which will provide the necessary support. The only other possibility would be to use rods or arbors extending through the core, or through one print if that is the only opening available.

Coating for Permanent Molds

We will appreciate any information on a suitable mold coating for production of aluminum alloy and bronze castings by the permanent mold process.

Permanent mold coatings usually are composed of some type of refractory material with or without a lubricating agent. In some cases the refractory also functions as a lubricant. Materials employed include whiting, clay, rouge, graphite, etc., used singly or in combination, and with or without addition of sodium silicate (water glass) as a suspending agent. Numerous proprietary mold coatings are on the market, and we advise use of those instead of trying to make your own.

If you have the latter urge you might try heating one gallon of water to boiling and then adding 10 oz whiting, 1 oz graphite powder, and 12 oz sodium silicate while stirring them well. The mixture should be allowed to cool before use, and stirred well before application. The mold should be heated to around 700° F before coating, and it is preferable to spray on thin coatings except around gate and riser areas where heavier coatings may be brushed on.

Describes Molding Practices

We have seen references to stack molding and multiple molding, and would like to know if they are the same, and how they are performed.

The term "stack molding" is applied to foundry operations where the molds are placed vertically on top of each other and use a common sprue to feed the cavities in the molds. Usually these cavities are in the upper face and the flat bottom of the succeeding mold in the tier forms the cope face.

The sprue hole in the bottom mold is plugged to prevent escape of the metal, and the cavities in the top mold are wasted.

Multiple molding is similar to stack molding except that cavities are formed in the top and bottom faces of the mold, and the bottom of the succeeding mold in the stack forms the cope of the mold beneath.

Molds usually are made on jolt-squeeze molding machines. In multiple molding a half pattern is mounted on the squeeze head of the machine in addition to the half pattern on the machine platen. Number of molds in a stack will depend on the depth of the flask, and the deeper it is the fewer the number needed to bring the stack to a convenient pouring height.

Since stack and multiple molding involves a comparatively large body of sand, close attention should be given to its conditioning. Sand should be open enough to permit easy escape of the gases generated by contact of the molten metal.

Slag Formation Is Problem

We recently purchased high-frequency induction furnace equipment, and while melting cast iron with either acid or basic lining we observe considerable slag build-up with the bottom and round portion of the furnace. We are not using any limestone or other fluxing material, and would like to know if we can eliminate the slag formation by any means. Also can you tell us what is the composition of the copper tubing used in the furnace coil?

Development of slag in the high-frequency furnace, as in any other furnace where the surface of the metal bath is exposed to oxidizing atmospheres, results from the formation of metal oxides and their subsequent reaction with the furnace lining, also from erosion of the lining caused by high temperature conditions at the metal-lining interface, and the stirring or rolling action of the molten metal against the lining due to electromagnetic forces.

Although you do not add any limestone to the iron charge, any sand, dirt, or rust on the raw materials form a source of slagmaking ingredients. Unless good quality materials are used for the linings, there may be some sloughing away or erosion. Attention also should be given to temperature control since excessive temperature conditions reduce lining life.

Although we do not have any

definite information on the composition of the copper tubing used in the coils of high-frequency induction furnaces, we suspect it is pure copper of the high-conductivity type since the tubing forms the primary electric circuit.

Mold Mixture for Patterns

We have some difficulty in cleaning cast iron matchplates which we make for our own use, and wonder if plaster of paris could be used instead of green sand.

Plaster of paris or gypsum applications are limited to production of castings in nonferrous alloys with pouring temperatures not over 2300° F since at temperatures around 2400° the material tends to break down chemically as well as physically. Hence, it would not be suitable for the purpose you have in mind.

Your cleaning problem should be overcome by use of fine-grain facing sand containing a small amount of seacoal which will provide smooth surface as well as good peeling. Too thick a facing on the pattern or too much seacoal in the facing sand may lead to blows.

Possibly the best procedure would be to use zircon sand as described in the October, 1958, issue in "Casting Iron Patterns in Zircon Sand" by C. W. Yaw. Molds and cores are made of the same mixture and baked. The mixture is made of 300 lb zircon sand, 6 lb iron oxide, 4.2 lb (2 qt) water, 3.5 lb (1¾ qt) core oil, 2.5 lb cereal, 2.0 lb clay, and 1.5 lb drier. Pouring temperature of the iron is given as 2500° F.

Proposes Design for Cupola

A short time ago you sent us some information on the construction of a cupola to melt 2000 kg per hour, holding 600 kg in the well, and from that we propose to build one according to the design shown in the accompanying sketch. Your comments will be appreciated.

Although your design probably would operate satisfactorily since it appears to follow blast furnace construction, we believe that a simpler design will suffice. Such a design is shown in the accompanying sketch, which also includes your design.

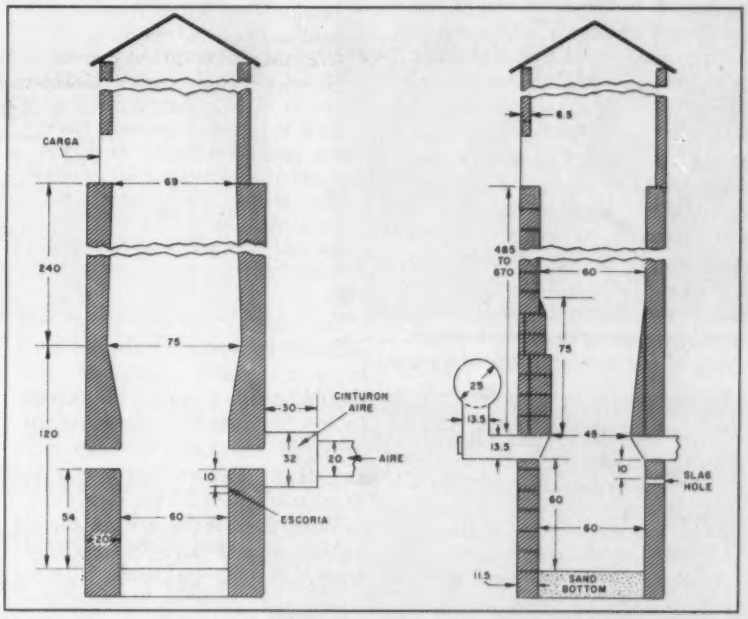
We do not know whether you propose to line the cupola with brick or with a rammed or "gunned" monolithic lining, so one half shows brick and the other half the monolithic construction to indicate the slight differences in making the bosh or constricted section of the cupola.

You will note that the lining thickness, except at the bosh section, is about 60 per cent of what you indicate; that amount has been found satisfactory in this country unless the cupola is operated for 8 hours or more. Then a thicker lining is used. Also, the wind or air belt is shown as a pipe mounted above the tuyere level, with other pipes or tubes connecting it to the individual tuyeres. With such an arrangement only the tuyeres are affected in case the molten iron in the well or reservoir rises sufficiently high to enter the tuyeres, and repairs can be made more easily than when a hole is burned in the wind belt.

You have a height of only about 290 cm from the tops of the tuyeres to the bottom of the charging door, and that height will not permit efficient use of the gases of combustion in preheating the metal charges descending in the cupola. Height recommended in this country is from 485 to 670 cm as shown in the sketch.

While we have indicated a decided diameter reduction in the bosh section, that is not a definite specification and may be adjusted to give a dimension any place between that and a straight wall. In fact, many cupolas in this country are operated with straight walls, from well to charging door except for a slight constriction resulting from patching the refractories burned out in the melting zone.

We have indicated a somewhat deeper well in the cupola since our calculations show that 600 kg of metal will occupy a volume of 83,333 cu cm.



Proposed and modified cupola designs. Dimensions are given in centimeters

Encounters Veining in Cores

We are making brass impellers and are not satisfied with the cores used because we encounter considerable veining and penetration. Can you suggest a core mixture that will overcome those problems? Also, we would like information on a suitable core wash to produce a reasonably smooth cored surface. The impellers are double-faced, closed type with eight loose curved vanes in a corebox about 10 in. in diam.

Metal penetration in cores may be due to use of coarse sand, soft ramming, poor quality sand, or perhaps too much phosphor-copper. Veining is attributed to sand which collapses too quickly. Without

knowledge of your present practices, it is somewhat hazardous to make suggestions for overcoming the difficulties without some experimentation. The best we can do is to provide a starting point from which you can carry on.

You might try a mixture of 125 lb silica sand of about 60 grain fineness, ¾ lb cereal, 1¼ lb iron oxide, and 1 qt core oil. If that sand does not provide a smooth enough surface, a finer grain size should be tried, or perhaps small additions of clay might be made. Of course, the cores could be coated with a wash, but we would avoid that if possible since it means a higher cost.

If you feel it necessary to employ a coating, you might try one containing 17 lb silica flour, 6.5 oz bentonite, 13 oz dextrine, 1 oz sodium benzoate, and 1 gallon water. If a carbonaceous type coating is preferred, graphite or plumbago can be substituted for part or all of the silica flour. Remember that use of water-base coating requires thorough drying of the core after application.

Scars and Rat Tails Occur

We are having some difficulty with stoveplate work made in snap flasks, but not when wood flasks are employed. The snap flask work has to have harder molds and they scar and rat tail. When rammed soft they wash since they are poured harder. The sand we are using is around 150 grain fineness with a green strength of 4.5 psi max, permeability 25 to 28, and 13 per cent clay. Do you think there is a natural sand available which has high permeability and clay content which would eliminate the trouble?

Your sand appears to be rather fine grain for the work in hand, and presumably is used to provide as smooth a surface as possible. As you point out, it works satisfactorily when it is not rammed very hard, but fine sand has a low pore space, and hard ramming reduces it still further. The reduction in pore spaces not only decreases the permeability, but also causes difficulty in that the reduction leaves no room for sand expansion. Hence, rat tailing and buckling occur on the mold face.

We believe it preferable to use a somewhat coarser sand in the range 90 to 100 with small additions of cereal, wood flour, seacoal, etc. Even when this sand is rammed hard, sufficient void space is available for expansion, and the combustible material burns out in contact with the molten metal, creating more space for expansion of the sand.

Changes with Hot Blast Use

In our foundry in Argentina we are planning to install hot blast equipment to provide a temperature of 300 to 400°C in the air entering our cupola. The cupola is lined to 70 cm and the air supply is at the rate of 36 cubic meters per minute with a pressure of 500 mm at the windbox. Air is supplied by a centrifugal fan. Since this installation is new to us we would like to know whether the blast pressure should remain the same with the hot blast as with the cold blast, and what difficulties might be encountered.

You should not encounter any difficulty incorporating the hot blast in your cupola operation. You should be able to obtain an increase in melting rate as well as an appreciable reduction in coke consumption. Reports indicate a reduction of about 25 per cent.

With this coke reduction, the air volume should be reduced accordingly. No change should be made in the blast pressure, however, since any reduction in pressure may lead to decrease in penetration of the air into the cupola.

You will have to experiment to obtain the most efficient operation with the hot blast. The transition from cold blast operating conditions to hot blast should be accomplished gradually in coke and air reduction. Unless the supplier of the hot blast equipment recommends specific changes, use your present practice on coke and air, and observe closely such factors as metal temperature, melting rate, etc. From those data you can make gradual changes to provide the most efficient operations. As each change is made, the condition previously mentioned should be observed carefully.

A figure commonly used in this country for purposes of calculation is that 130 cu ft of air are required to burn 1 lb coke, or 8.12 cu m per kg of coke. From your figure of 36 cu m per minute, indications are that at an 8:1 iron to coke ratio you are melting about 2128 kg of iron per hour. Another figure commonly used to ascertain the theoretical melting rate of a cupola is 10 lb per sq in. of cross-sectional area, or 0.703 kg per sq cm. In your cupola lined to 70 cm the theoretical melting rate should be about 2700 kg per hour, but often that rate is not accomplished due to coke quality, iron to coke ratio, etc.

Coloring of Bronze Markers

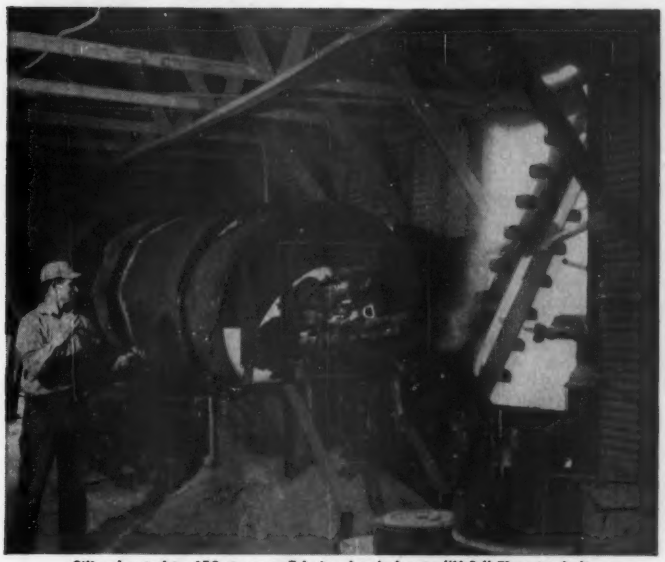
I operate a small nonferrous foundry making bronze grave and other markers and plaques from M metal (88-6½-1½-4). They are given an oxidized finish with liver of sulfur followed by a baked-on Nubelite finish. However, I have some customers desiring different finishes on which I would like some information. One is a green or verdigreen finish. I tried a formula I found in a book, but it did not work. Another is a finish supplied by others in the field. That finish looks as though the markers were given a color finish, and then after highlighting, a clear finish is applied to protect the bright work.

Green color or patina on copper-base alloys usually is developed by use of copper nitrate or copper acetate solutions. One suggested formulation is composed of 4 oz each of copper nitrate, ammonium chloride and calcium chloride dissolved in 1 gallon of water. Another is made up of ½ gallon of acetic acid, 20 oz ammonium chloride, 7 oz sodium chloride, 7 oz cream of tartar, 7 oz copper acetate and ½ gallon of water. Color is developed by stippling the solutions on the object or casting.

Still another consists of 1 lb of commercial copper nitrate dissolved in 1 gallon of water or ¾ lb copper nitrate and ¼ lb zinc nitrate in 1 gallon of water. With those solutions the work to be colored is heated to around 250° F, and the solution swabbed or brushed on.

With reference to the second finish you mention, it appears to us that you have supplied the answer —that is, markers or plaques with letters or raised ornamentation are polished and buffed to the original metal color after the depressed background is given a color finish. After rinsing and drying, the piece is coated with water-white lacquer, preferably by spraying.

HOT MATERIALS ELEVATOR BELT



Silica heated to 450 degrees F being loaded onto "U.S." Elevator belt.

"U.S." Elevator belt carrying hot silica up to and discharging it into chute.

"Terrific heat, terrific weight, high abrasion . . . all combine to severely tax elevator belts. But this U. S. Rubber Belt has been on the job 3 times longer than any belt previously used," says co-owner J. C. Barry of Barry & Barry Sand Co. (Silsbee, Texas) producers of foundry, chemical and specialized sands.

J. C. and J. W. Barry watch the hot silica being funneled into loader equipped with "U.S." loader belt.

"We have two U. S. Rubber elevator belts here," he adds. "We need belts that will last a long time, which means belts that are not bothered by terrific heat (up to 450 degrees F.) terrific weight, plus the abrasive action of sand. So far, each of these belts has outlasted the belts of other makes while showing no signs of wear. *These belts never fail us...no lost production, no downtime.* We are very satisfied. They do our job best."*

It is performance such as this that has made U. S. Rubber the largest manufacturer of conveyor and elevator belts.

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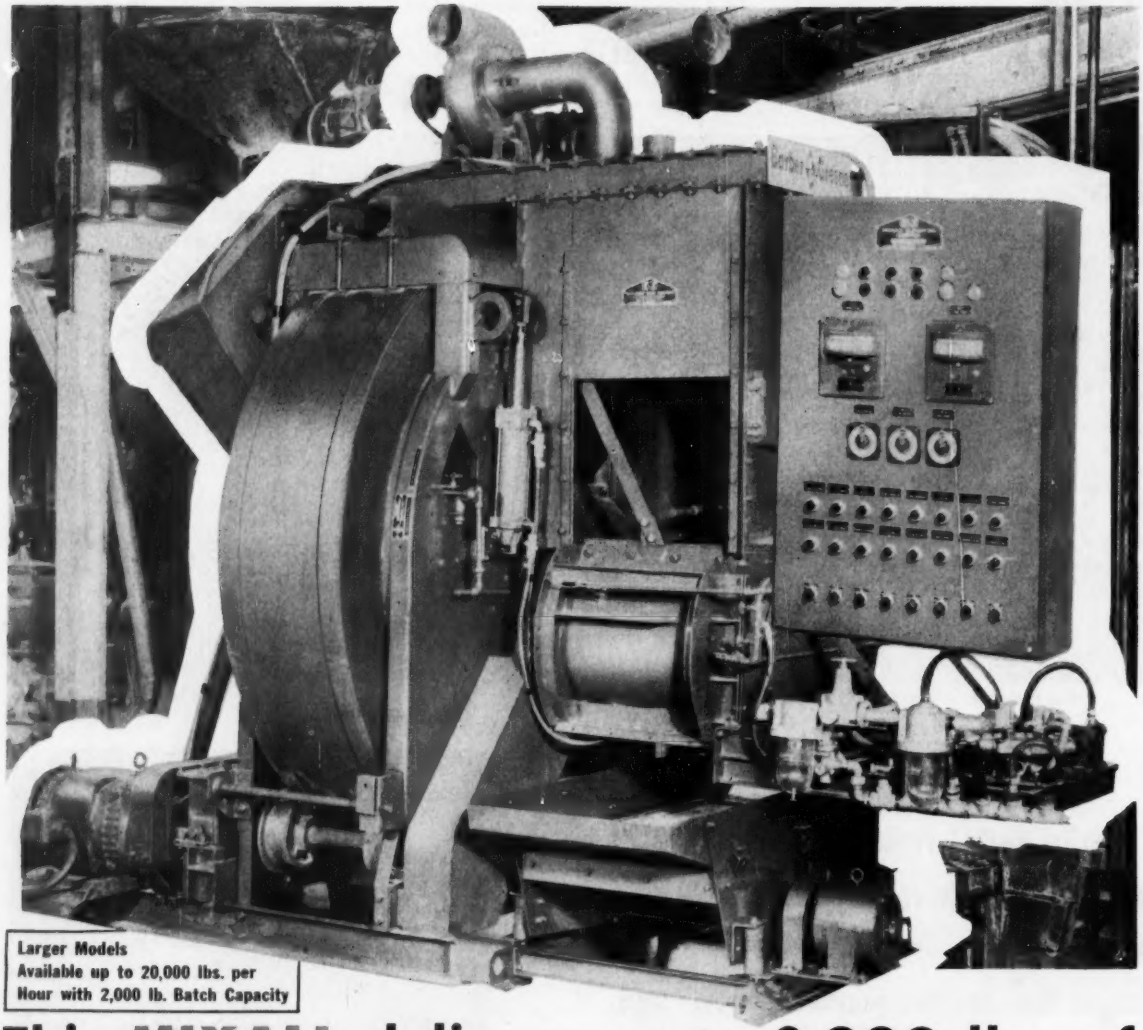

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For More Information
Use Reply Card—Page 53

What's New in Equipment and Supplies

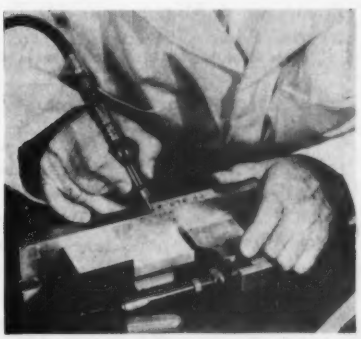
UNDERHUNG CRANE

Meco-Matic crane can be operated on over 40 standard structural I-beam sizes, wide flange beams, and on hardened monorail track. The end trucks will traverse the junction of unlike beams. End truck wheels are flangeless and aligning. Alignment is supplemented by side guide rollers bearing against the beam web, acting as rolling flanges and as safety lugs. Crowned wheels are reversible for double life. Motor-driven, hand-geared, or push type models are available.—**Mechanical Equipment Co.**, Dept. 119, 3100 Prospect Ave., Cleveland 15, Ohio

For More Details Circle No. 450—Page 53

AIR MARKING PEN

Air pen, for engraving part numbers on aircraft and missile components and marking jigs, tools, and fixtures, adapts to any type of material by adjustment of the speed



of the blow. Tool's carbide cutting tip is held in a collet for easy removal. Pen weighs 9 oz and is 7¾ in. long.—**Thor Power Tool Co.**, 175 N. State St., Aurora, Ill.

For More Details Circle No. 451—Page 53

NOISE INTEGRATOR

Noise integrator is designed to provide either integrated noise level readings, indicating total noise ex-

posure in time units measured during five-second cycles, or average noise level readings in areas of rapidly fluctuating sound. Instrument is used in conjunction with a survey meter. Using the data collected, it is possible to predict anticipated hearing loss resulting from a five-year exposure to particular sound levels.—**Mine Safety Appliances Co.**, 201 N. Braddock Ave., Pittsburgh 8, Pa.

For More Details Circle No. 452—Page 53

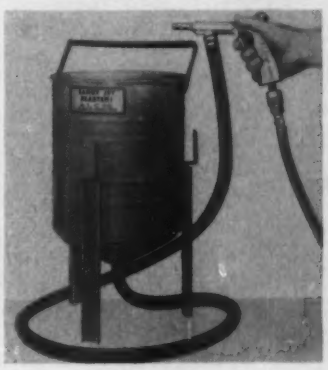
BATTERY CHARGERS

AutoReg silicon rectifier equipment is designed for recharging batteries of 12-v electric trucks. Model ARI-8 charges batteries up to 300 amp-hr capacity in 8 hr. Model AR2-8 handles batteries up to 450 amp-hr capacity in the same time. Chargers plug into any standard 15-amp, 115-v, single-phase, 60-cycle outlet. Unit is fully automatic. Timer switch, ac fuse, and ac on-off pilot light are centralized on the blue instrument panel.—**C & D Batteries Inc.**, Washington and Cherry Streets, Conshohocken, Pa.

For More Details Circle No. 453—Page 53

PORTABLE SAND BLASTER

Sandy Jet sand blaster is equipped with a pistol-grip-type blast gun which makes the unit powerful and easy to use. Tool uses all types of abrasives with three sizes of nozzles and does not require a separate or special room. Included with



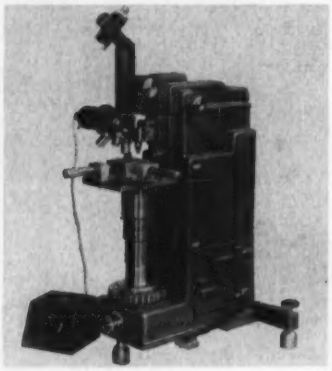
each unit are an operator's hood, a face shield, and two extra nozzles.—**ALC Co.**, R. D. 5, Box 40, Medina, Ohio.

For More Details Circle No. 454—Page 53

HARDNESS TESTER

Kentron micro hardness tester applies deadweight loads from 1 to 1000 grams. Additional weights up

to 10,000 grams can be furnished as optional equipment. Unit has vertical capacity of 8 in. and is de-



signed to test unmounted parts so that they can be returned to production or stock.—**Torsion Balance Co.**, Clifton, N. J.

For More Details Circle No. 455—Page 53

CARTRIDGE HEATERS

Electric cartridge heaters are for such localized heating applications as die blocks, platens, molds, packaging, and embossing machines. The units fit into standard drilled holes in platens and die blocks which are used in direct contact with the object to be heated. The cartridge can be used singly or grouped together, depending on the surface size to be heated. All heaters operate at 750° F maximum temperature, 60 watts per square inch, and are rated from 200 to 2800 w. Sizes range from 2½ to 12 in. long and from ½ to 1 19/64 in. in diam.—**General Electric Co.**, Schenectady 5, N. Y.

For More Details Circle No. 456—Page 53

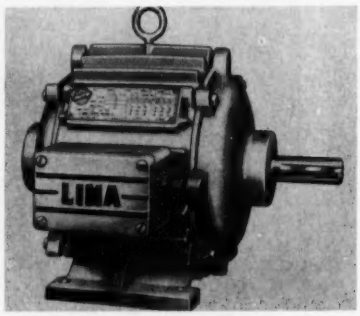
ROOF VENTILATOR

Power roof industrial ventilator is available in capacities from 8000 to 80,000 cfm. The ventilator sweeps up heat, moisture, dust, and fumes, exhausting them in a jet that shoots 20 to 30 ft above the roof. The only maintenance work normally required is annual removal of accumulated dirt with a long-handled wire brush. When the propeller fan is turned on, a pair of automatic dampers opens to provide an unobstructed exit for the air. When the fan is off, the dampers close and form a leakproof seal.—**Structa-Lung Co.**, 36407 Euclid Ave., Willoughby, Ohio.

For More Details Circle No. 457—Page 53

FAN DUTY MOTOR

Type EFD fan duty motor is available in rerated NEMA frame sizes 182 through 326U, ½ to 15



hp. Motors are offered in 1800, 1200, or 900 rpm. Units feature all enclosed housings and deep external cooling fins with a reduced transverse section to give low wind resistance. Duty rating is continuous, and temperature rise is rated at 55° C. Features include die-cast rotors, dynamically balanced, and double-width prelubricated sealed ball bearings.—**Lima Electric Motor Co. Inc.**, Dept 156, Lima, Ohio.

For More Details Circle No. 458—Page 53

AIR DIE GRINDER

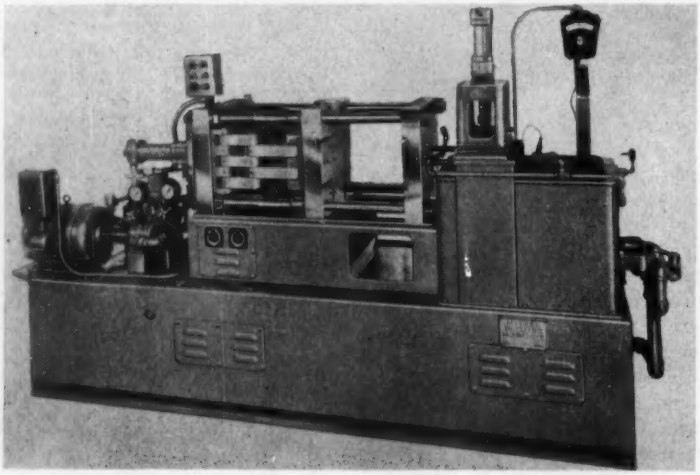
Model 1600 air die grinder is recommended for polishing, wire brushing, and metal removal on dies, stampings, gear teeth, plastics, tubes, castings, and weldments. Metering trigger delivers up to 25,000 rpm. Grinder has a three-bladed motor in a one-piece aluminum impact housing.—**Superior Pneumatic & Mfg. Inc.**, 13800 Enterprise Ave., Cleveland 35, Ohio.

For More Details Circle No. 459—Page 53

GAS WELDING RODS

Thin extruded flux coating is the major feature of bronze gas welding rods. The coating is odorless, smooth, and concentric. It reportedly will not flake under normal operating conditions and has excellent cleansing action. High-speed production rods are for use where only a small amount of flux is needed to prepare and clean the weld. Units resist moisture and can be stored indefinitely in high

Diecasting Machine Has Design Improvements



Model 150Z hot chamber diecasting machine has major improvements including a 950-lb melting pot and new gooseneck design that is said to lengthen service of the machine. Safety shot die interlock has been redesigned for more safety from molten metal dangers to operators. Model has 4-lb zinc shot capacity up to 500 shots per hour. Die platens are 20 x 21 in. Machine features solid steel toggle links which are said to be exclusive in the field.—**American Die Casting Machinery Co.**, 1752 W. Winona St., Chicago 40, Ill.

For More Details Circle No. 492—Page 53

Power Operated

SHELL CORE BLOWER

Handles core boxes up to 11" high by 13" wide and 10" deep

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Produces up to 120 cycles per hour

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Sand hopper Capacity of 70 pounds

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MODEL CBM-1

This Shell Master CBM-1 has features designed for accuracy, speed and ease of operation. You're assured accurate alignment with long-wearing chrome guide bars and replaceable nylon bushings. Normal cycle of the closing piston is rapid traverse, slow closing. Standard equipment includes eight 700 watt heating units.

For further information, write or phone:

Circle 602 on Page 53

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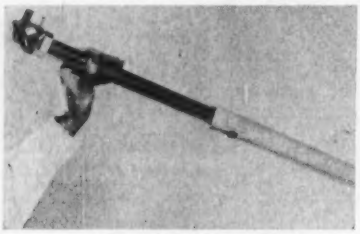
humidity areas. Rods are supplied in four diameters—3/32, 1/8, 3/16, and 1/4-in.—**Air Reduction Sales Co.**, division of Air Reduction Co. Inc., 150 E. 42nd St., New York 17, N. Y.

For More Details Circle No. 460—Page 53

THERMOCOUPLE ASSEMBLY

Alodure thermocouple assembly is designed for molten aluminum,



magnesium, and lead applications. The protecting tube, consisting of an immersion length of reinforced base material effective up to 2200° F, is said to exhibit the strength of a metal protecting tube and resistance to wetting. Unit has 1¾-in. OD and is available in seven sizes from 12 to 48 in.—**Sales Dept., Pyrometer Co. of America Inc.**, Penndel, Pa.

For More Details Circle No. 461—Page 53

INFRARED HEATERS

Portable, gas-fired, infrared radiant heaters can concentrate heat on specific areas with polished parabolic reflectors without heating the surrounding air. Heaters are available in three sizes. The two larger sizes are mounted on a vertical support rod attached to a wheeled propane bottle carrier. Larger unit is rated at 36,000 Btu and operates for less than 15 cents an hour. Smaller unit is rated at 24,000 Btu and costs less than 10 cents an hour to operate. Seven adjustment positions are provided, from 3½ to 7 ft high. —**Perfection Industries**, division of Hupp Corp., 1135 Ivanhoe Rd., Cleveland 10, Ohio.

For More Details Circle No. 462—Page 53

CONVEYOR LUBRICATORS

Series 110 automatic conveyor lubricators for spray lubrication feature individual adjustment of wheel nozzle and manifold. The 2-gal reservoir is constructed of cast aluminum to handle air line pressures up to 125 psi. As each pair of trolley wheels passes the lubricator, the wheels trip the trigger which automatically releases jets of oil-fogged air.—**J. N. Fauver Inc.**, 51 W. Hancock, Detroit 1, Mich.

For More Details Circle No. 463—Page 53

HYDRAULIC POWER UNIT

Multi-pump hydraulic power unit is L-shaped to reduce the amount of external piping and valve panels necessary. With the top removed, fluid from individual drain and return lines can be seen while the unit is running. External connections are brought out to a flanged manifold for easy hookup.—**Double A Products Co.**, subsidiary of Brown & Sharpe Mfg. Co., Manchester, Mich.

For More Details Circle No. 464—Page 53

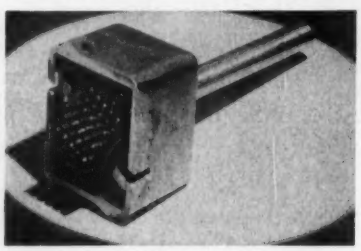
SUSPENSION SCALES

Automatic suspension scale is calibrated with certified test weights to an accuracy of 1/10 of 1 per cent and is sealed by the Bureau of Weights and Measures before shipment. Principle of operation of Model P is based on compound levers. Mechanism is dampened against vibration or flutter. Reset or tare adjustment knob is provided, and ball bearing swivel hook revolves freely under maximum load. —**W. C. Dillon & Co.**, 14620 Keswick St., Van Nuys, Calif.

For More Details Circle No. 465—Page 53

GRINDING WHEEL DRESSER

Model 10 grinding wheel dresser is made of high-tensile cast aluminum alloy. Cutters and abrasive



wheels are interchangeable. Built-in tangential angle of cutters and wheels eliminates need for a breaking device. Model will fit standard Peterson cylinder head and Lempco grinders.—**L. Newman**, 1001 24th St., Oakland 7, Calif.

For More Details Circle No. 466—Page 53

PLASTIC REFRACTORY

Plibrico 80 plastic refractory is designed for extremely high-temperature service in aluminum remelt furnaces, electric furnace roofs, and aluminum and brass ladles. Alumina content is 80 per cent. Service temperature limit of the material is 3300° F and service range is 2000 to 3200° F. Abrasion and acid resistance are said to be excellent. Product is available as heat-setting or air-setting material. Both are dense materials packaged in moisture-resistant cartons.—**Refractory Div., Plibrico Co.**, 1800 N. Kingsbury St., Chicago 1, Ill.

For More Details Circle No. 467—Page 53

EAR PROTECTOR

Quiet-Ear protector is for areas where noise becomes a hindrance or nuisance. The lightweight, inexpensive protector does not use bulky

absorbing materials or large sealing shells. It is easily adjustable.—**Bausch & Lomb Optical Co.**, 635 St. Paul St., Rochester 2, N. Y.

For More Details Circle No. 468—Page 53

WELDING KIT

Weld Help Kit is a sample package which contains 8 diameters of carbon rods, 3 thicknesses of carbon plate, a can of carbon paste, and a can of Protex surface protection compound. Also included is an illustrated manual showing applications of the materials.—**Arcair Co.**, P. O. Box 431, Lancaster, Ohio.

For More Details Circle No. 469—Page 53

DUST COLLECTOR

Features of self-cleaning dust collector include lack of moving parts, constant air flow and pressure drop, and automatic filter tube cleaning. In operation, the cylindrical unit receives dust-laden air through a tangential cyclone ring. Heavier materials are dropped, and the lighter materials are collected on the outside of the filter tubes, which

Famous CORNELL
CUPOLA FLUX

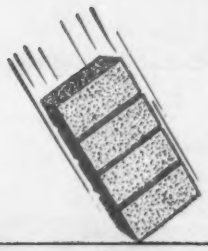
There's a Connection Between

and CLEAN IRON for Gray Iron and Malleable Iron Foundries

Gray iron and malleable iron foundries with cupolas take pride in quality metal—know a fluidizer is a must! That's why so many insist on Famous Cornell, the metal-purifying flux that eliminates foreign matter from molten iron by increasing slag flow off.

Use Famous Cornell Flux and you'll notice the tensile strength of your castings is higher and they are much easier to machine. Famous Cornell Flux also reduces patching downtime by imparting a protective glazed surface on cuploa linings.

Write for Bulletin 46-B and a sales engineer to show you how Famous Cornell Flux can help you.



IF you melt aluminum, copper or brass, try Famous Cornell Aluminum, Copper or Brass Flux. Write for Bulletin 46-A.

"often imitated but never equalled"

The CLEVELAND FLUX Company
1026-40 MAIN AVENUE, N.W. • CLEVELAND 13, OHIO
Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes—Since 1918

FAMOUS CORNELL FLUXES
Trade Mark Registered

GEORGE F. PETTINOS, LTD., Hamilton, Ontario, Canada
Exclusive Representatives in Canada

LET'S LOOK at

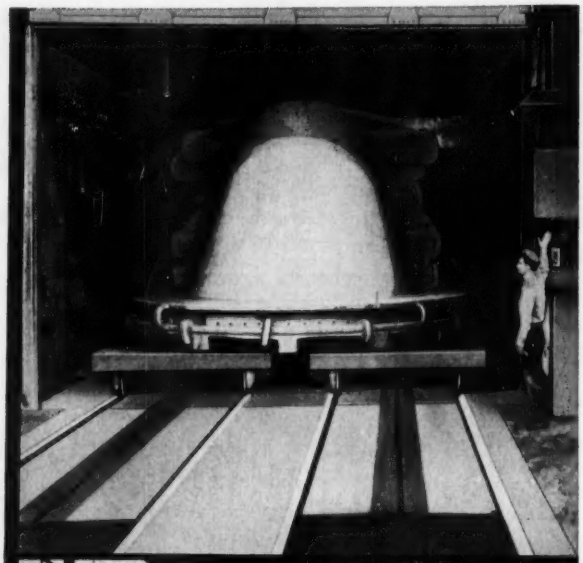
OVENS for every baking requirement

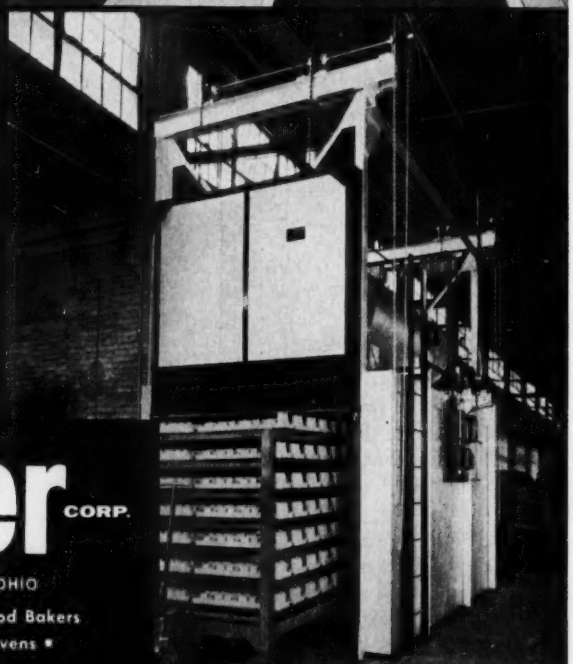
OVENS that will be faster and less expensive to operate

OVENS that are designed to best fit your operation

Carl Mayer designs and manufactures all types of ovens as well as "specials" to meet unusual operating conditions. Most incorporate the Carl Mayer recirculating heating system with sealed combustion chamber that keeps gases from prematurely escaping into the load area. Cores and molds are baked evenly with no burning. Temperatures are always under control.

Write for Bulletin 53-CM





TOP RIGHT—This large car type mold oven is installed at Pittsburgh Steel Foundry. Its special triple slotted panel construction reduces heat loss 1/3. Fuel savings up to 50% over old conventional methods are possible. Drying time is often cut in half and temperatures are uniformly controlled.

MIDDLE RIGHT—This rack type core baking oven is at the Fremont Foundry Co., Fremont, Ohio. It is equipped with a recirculating combination gas-oil fired heating system.

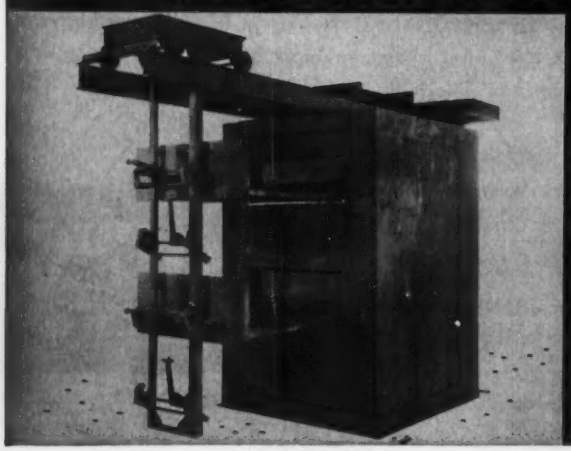
BOTTOM RIGHT—Vertical Core Oven (unloading position) at A. C. Williams Company, Ravenna, Ohio. This oven is 11'-0" wide x 11'-0" deep x 45'-0" high.

BELOW—Our standard rolling drawer type core baking oven. The heating equipment (not shown) may be mounted on floor beside unit or on the roof. Particularly adaptable to brass and aluminum foundries.

THE **carl mayer** CORP.

20800 CENTER RIDGE ROAD CLEVELAND 16, OHIO

OTHER PRODUCTS: Heat Treating Ovens and Furnaces • Rod Bakers • Welding Rod Ovens • Paint and Ceramic Drying Ovens • Special Processing Equipment and Accessories



are flexed taut intermittently by sharp bursts of compressed air. This action cleans the filter tubes constantly. Collector can be suspended from the ceiling or floor mounted.—**Flex-Kleen Corp.**, 406 S. Plymouth Court, Chicago 5, Ill.

For More Details Circle No. 470—Page 53

SAFETY GOGGLES

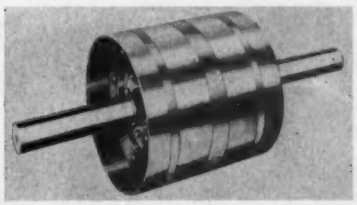
Coverglas goggles are said to fit 99 per cent of users. The goggles fit over prescription glasses and use

standard 50-mm round lenses to reduce lens stocking problems. Chipper's goggle, shown here, has perforated aluminum side shields for direct ventilation, adjustable leather bridge, and clear lenses. The welder's model is the same, but has indirectly ventilated side louvers and shade lenses. Frames are cellulose acetate in opaque brown.—**Safety Products Div., American Optical Co.**, Southbridge, Mass.

For More Details Circle No. 471—Page 53

PERMANENT MAGNET PULLEYS

Indox V permanent magnet pulleys are for heavy duty operations such as tramp iron removal and



cobbing applications. The inexpensive pulleys feature a barium ferrite ceramic magnet material and are available in diameters from 12 to 48 in.—**Stearns Magnetic Products**, 635 S. 28th St., Milwaukee, Wis.

For More Details Circle No. 472—Page 53

HYDRAULIC DUMPER

Hydro-Dumper 515 has a capacity of 3 tons or more and is designed to operate on in-plant or outside angle tracks. The dumper carries bulk material to any location along tracks, stops, and dumps the load. Skip pivots from loading position, 135 degrees, to a 45-degree dumping angle. Skip sizes and shapes are variable. Unit has two separate motors, one to dump the skip, the other to propel the dumper along the track. Four-way control valve gives the operator command during the dumping operation.—**Essex Conveyors Inc.**, 101 Colden St., Newark 3, N. J.

For More Details Circle No. 473—Page 53

INFLATED SANDING DRUM

Model 890 Valcore inflated sanding drum is for use with coated abrasive bands up to 9 in. wide. The contact drum features a resiliency which allows the abrasive to follow contours and present more abrasive to the work. A large working area is provided across the abrasive surface because no part of the core or side plates extends above the abrasive. The leakproof drum requires no adhesive or sealant to fasten the drum to the core. Standard bore

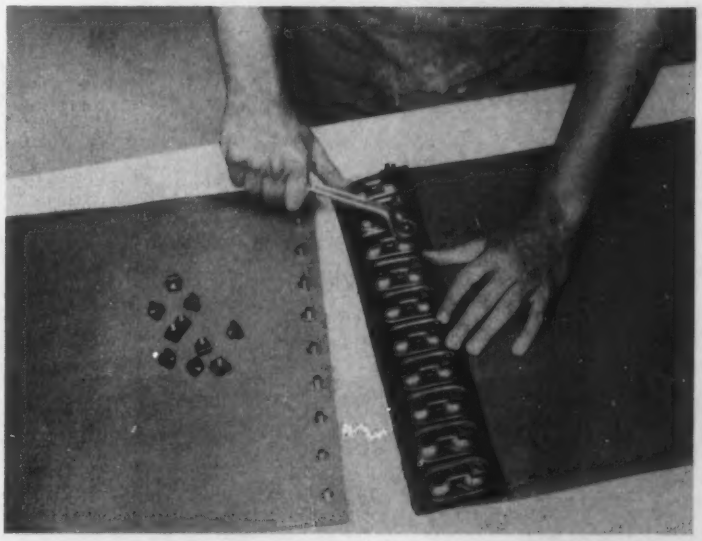
size is 1¼ in., and larger sizes are available. Floor-mounted, adjustable, and variable speed model spindle stands can be used to drive the drum. Operating speed is 1200 or 1800 rpm.—**Nu-Matic Grinders Inc.**, 8224 Carnegie Ave., Cleveland 3, Ohio.

For More Details Circle No. 474—Page 53

MILLIVOLT POTENTIOMETER

Designed for inplace checking of thermocouples, recorders, and controllers and for temperature measurement tests and calibration studies, portable millivolt potentiometer

Fastener Improves Elevator Belt Joining



Jackson fasteners have been developed to provide strong elevator belt joining. Fastener plates are curved to round pulleys easily and ride only on the bucket side of the belt. This design allows no metal-to-metal contact on the pulleys. Toothed washers draw the belt up firmly in the concave underside of the plate. Loosening, rotation, or pullout of nuts is avoided because the nuts are piped and have extra long grab to gather all metal parts out of pulley reach. The fasteners are strengthened by special heat treatment.—**Imperial Belting Co.**, 1750 S. Kilbourn Ave., Chicago 23, Ill.

For More Details Circle No. 493—Page 53

PRODUCTION FIELD REPORT:

The W. O. Larson Foundry Company, Grafton, Ohio

- Jobbing foundry, 225 employees.
- Produces all ASTM specified irons, C-Iron and Ductile Irons—in weights from less than one lb. to 28,000 lbs.
- Annual production—exceeds 10,000 tons.
- Specialty—high-precision work with unusually fine finish.

How

910 JET-CORE AT LARSON produces cores 2″ x 4″ to 10″x 15″ and up to 8″ deep. Handles box sizes 4″ x 6″ to 12″ x 17″ *wood or metal*, split or dump types.

they cut bench core production time by 2/3

and get increased flexibility with this

OSBORN JET-CORE

THIS WIDE RANGE OF CORES is all easily and rapidly blown on the compact Osborn 910 *Jet-Core* at Larson Foundry.

Here—on-the-job at Larson—production time on bench cores has been cut by as much as ⅔ with this Osborn *Jet-Core* automatic core blower.

Since installation of the unit at Larson—about ¾ of all bench cores are now machine-blown. The *Jet-Core* delivers extremely high-quality cores . . . and does the job *using standard production sand.* Quick-change blow heads and blow plates speed set-up time and further increase *core-room flexibility.*

Designed for use in production, semi-production or jobbing foundries—the *Jet-Core* affords many unique field-proven features and advantages: Sand "*moving action*" produces quality cores and allows use of a wide variety of core-box types without damage . . . stationary head with no reservoir movement for filling . . . table adjusts and locks hydraulically . . . clean, simple, one push-button operation.

Jet-Core delivers highest quality cores faster . . . at lowest possible cost. Write us for details on how a *Jet-Core* can go to work cutting *your* costs. *The Osborn Manufacturing Company, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

MEMBER FEMA

leader in mechanization for the foundry OSBORN®

CORE BLOWERS • MOLDING MACHINES • METAL FINISHING MACHINES • INDUSTRIAL BRUSHES

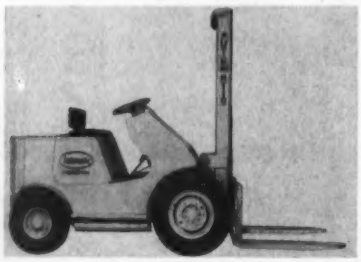
Circle 605 on Page 53

has a range of −11 to +101 mv. Manually operated reference junction temperature compensator minimizes computation by measuring net emf directly.—**Leeds & Northrup Co.**, 4934 Stenton Ave., Philadelphia 44, Pa.

For More Details Circle No. 475—Page 53

FORK TRUCK

Pneumatic - tired, gas - powered, electric-driven fork truck is designed to provide optimum torque output at a lower rpm requirement. The

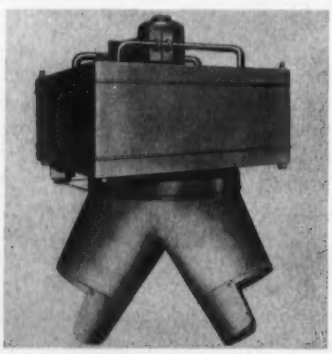


gasoline engine transmits power through a variable voltage generator to a matched direct current series wound electric drive motor, forming a synchronized power which supplies energy for starts and acceleration. Transmission of road shock is eliminated because direct mechanical coupling between the engine and drive axle is not required.—**Automatic Transportation Co.**, 149 W. 87th St., Chicago 21, Ill.

For More Details Circle No. 476—Page 53

CIRCULATING FANS

High-level circulating units consist of fan, plenum chamber with air guides, and revolving or fixed



discharge. The fans draw in heated air which collects at the ceiling and recirculate it downward. Revolving discharge constantly changes the direction of downward flow, preventing hot spots and the blocking of flow by machines and obstacles. With addition of duct intakes from the roof, the units can be used to circulate fresh air in summer.—**L. J. Wing Mfg. Co.**, Linden, N. J.

For More Details Circle No. 477—Page 53

MOLD-RELEASE OIL

Mold release oil for spray application reportedly prevents adhesion of casting metal to diecasting molds and creates bright, stain-free surfaces. Lubricant develops comparatively less fog during diecasting operations and is said to produce diecastings with less porosity.—**Sun Oil Co.**, Industrial Products Dept., 1608 Walnut St., Philadelphia 3, Pa.

For More Details Circle No. 478—Page 53

SCALE PREVENTIVE

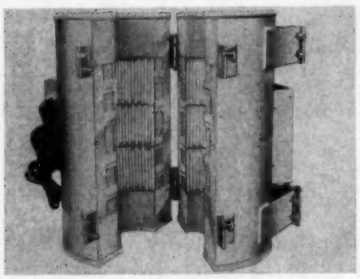
Skalix coating which prevents scale formation on metal during heat treatment can be applied to stainless steel, nickel-chrome alloys,

cobalt alloys, copper alloys, and others. Material is applied by spraying or dipping. Illustration shows three test plates of 15-7 PH coated with Skalix and treated in an oxidizing atmosphere for 30 min at 1950° F. As the metal cools, the coating comes off by itself.—**Los Angeles Div., North American Aviation Inc.**, International Airport, Los Angeles 45, Calif.

For More Details Circle No. 479—Page 53

VERTICAL TUBE FURNACES

Used in tensile and creep testing machines, standard vertical-tube furnaces are available in three maximum temperature ranges. The units are offered as solid-tube furnaces or in the hinged type design, as shown, which allows the user to place specimens in the test rig, swing the furnace into position, and clamp it around the test piece. Heating chambers can be divided into three or more zones of control, each regulated by a variable transformer with stepless control. Length of the uniform temperature zone is extended by the independent control of each zone.—**Hevi-Duty**



Electric Co., division of Basic Products Corp., P. O. Box 563, Milwaukee 1, Wis.

For More Details Circle No. 480—Page 53

PORTABLE GAS HEATER

Portable gas heater for heating isolated spots is available in single, double, or triple stack. Unit operates on any type of gas at pressures of 6 oz to 2 lb. Framework is heavy-gage steel, and heating tubes are stainless steel with built-in baffle. Heater is 72 in. high. A single-stack unit produces 160,000 Btu per hour while consuming 150 cu ft of natural gas.—**Union Chill Mat Co.**, General Delivery, Saxonburg, Pa.

For More Details Circle No. 481—Page 53

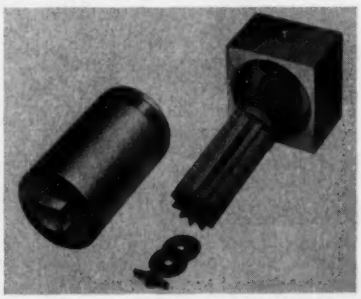
MAGNETIC SUMP STRAINER

Magnetic sump strainer has built-in circular magnets placed between the removable filter discs at specific intervals to trap iron filings. Screens remove nonmagnetic matter, and the rest of the unit catches magnetic particles. When strainer is disassembled, iron particles drop off the dics covers.—**Filter Div., Ripley Screen & Strainer Co.**, 32749 Northwestern Highway, Farmington, Mich.

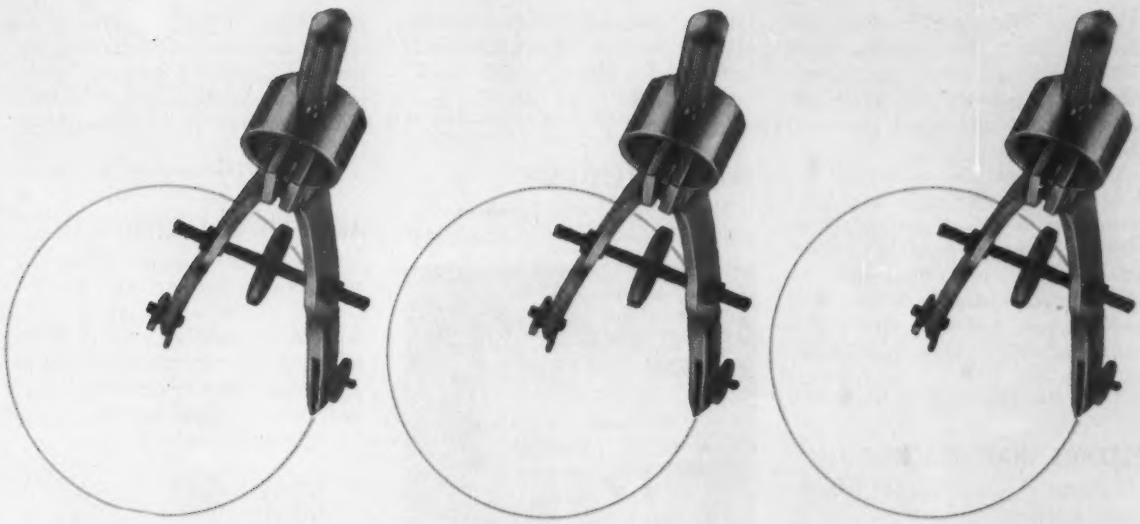
For More Details Circle No. 482—Page 53

HYDRAULIC FLUID FILTER

Hydraulic fluid filter features sintered bronze 40-mu filter element. Filter area of the ⅜-in. size is 35



sq in. An accumulation of foreign matter causing a pressure drop up



POSITIVE DUPLICATION–EVERY TIME!

As surely as a drawing compass can produce identical circles, you can be sure of getting Positive Duplication with these floor stand grinding wheels, and with *all* CINCINNATI (PD) ° SNAGGING WHEELS.

This predictable uniformity is the result of Cincinnati's unique 36-step (PD) manufacturing process. These rigid controls achieve tolerances for wheel inside diameters which are the "tightest" in the industry. Your (PD) WHEELS have better balance and last longer.

"PD" PAYS OFF FOR YOU

Your cleaning room costs will go down, when you start using CINCINNATI (PD) WHEELS. Our grinding specialists are at your service, to work with you in finding the best grading for your stand, swing frame and portable grinders. Once you have the (PD) WHEELS that give you the lowest labor and wheel cost, you can keep those costs down, because each reorder wheel will act and grind exactly like the original wheel . . . thanks to Positive Duplication.

CUT COSTS . . . CALL CINCINNATI

For experienced help on cutting costs, call your CINCINNATI (PD) GRINDING WHEELS Distributor, or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

(PD) POSITIVE DUPLICATION

CINCINNATI° GRINDING WHEELS

°Trade Mark Reg. U.S. Pat Off.

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

Circle 606 on Page 53

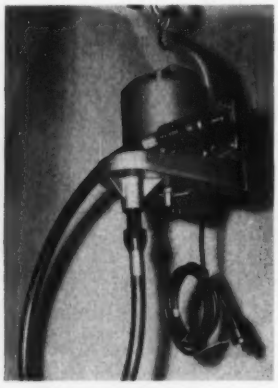
to 400 psi will not disintegrate the element. At higher pressure drops the element can crack, but downstream components are protected from particles and small pieces of the element.

Filter element can be cleaned by washing in a solvent and reverse blowing with air. Unit is rated at 1000 psi operating pressure. Filters are used with petroleum, ester, or glycol-based hydraulic fluids, silicones, water, and air.—GPE Controls Inc., 240 E. Ontario St., Chicago 11, Ill.

For More Details Circle No. 483—Page 53

FLEXIBLE SHAFT MACHINE

Lightweight multispeed flexible shaft machine model VJ-38 has a swivel hook for suspending the machine. Unit has 5 ft long ⅜ size shaft with neoprene rubber casing. Handpiece has high speed ball bear-



ings and an arbor for attachments. The ¼-hp, 1725-rpm motor has three speeds.—**Stow Mfg. Co.**, 23 Shear St., Binghamton, N. Y.

For More Details Circle No. 484—Page 53

SYNTHETIC HYDRAULIC OIL

Anderol L-386 is a medium viscosity synthetic diester with operating temperature range of −65° to 350° F. This hydraulic oil reportedly has built-in rust and antifoam protection. Lubricant is nongumming.—**Lehigh Chemical Co., Industrial Lubricant Div.**, Chestertown, Md.

For More Details Circle No. 485—Page 53

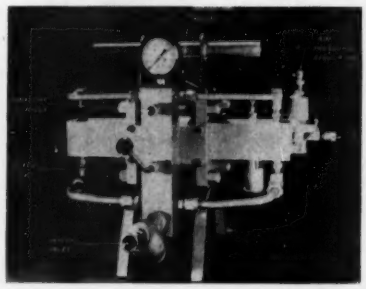
SAFE PENDENT SWITCH

Lightweight, 2-button model, safe pendent switch is designed for circuits up to 460 v, 20 amp. Unit features watertight, integral button and housing design for electrical insulation. Switches are of precision snap-action type.—**Electrical Products Div., Joy Mfg. Co.**, 1201 Macklind Ave., St. Louis 10, Mo.

For More Details Circle No. 486—Page 53

PRESSURE TEST UNIT

Model 5-TU high pressure test unit is portable and compact. It



tests leaks at pressures from 250 to 5000 psi. Unit operates by compressed air at 80 lb pressure. The testing machine requires connection to existing water and air lines and to the test piece.—**Logemann Bros Co.**, 3134 W. Burleigh St., Milwaukee 10, Wis.

For More Details Circle No. 487—Page 53

FINISHING MACHINE

Vibration has a built-in, removable, double-decked, vibrating separator in its base which separates parts and media in one operation. Machine can be fed from a hopper, and parts are discharged onto a conveyor. Unit uses short time cycles and is designed to finish complex cast, forged, stamped, and machined

parts with shielded, internal surfaces.—**Roto-Finish Co.**, 3700 Milham Rd., Kalamazoo, Mich.

For More Details Circle No. 488—Page 53

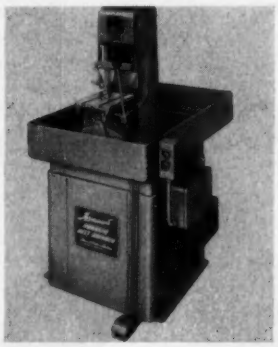
PLASTIC SEALER-FILLER

Bondzall plastic filler and sealer is said to repair permanently. The adaptable plastic reportedly will not rust, disintegrate, or corrode and has high impact strength. Cure time is readily controllable. Material is offered in containers from half pints to drums.—**Fybrglas Industries Inc.**, 3010 Montrose Ave., Chicago 18, Ill.

For More Details Circle No. 489—Page 53

ABRASIVE BELT GRINDER

Model VHP-6 abrasive belt grinder features a water-cooled and lubricated platen which reduces friction and temperature. Coolant splash of the 6-in. platen grinder is controlled with a modern hood, pan, and sprayer. Hood door is recessed for right-angle work. Platens are re-



versible top to bottom for maximum wear.—**Hammond Machinery Builders**, 1605 Douglas Ave., Kalamazoo, Mich.

For More Details Circle No. 490—Page 53

BAND MACHINES

Contour-matic band machines featuring power feed work tables are available in four throat depths —16, 26, 36, and 60 in. The 16 and 36-in. machines are intended for tool room and manufacturing, and the 26 and 60-in. machines are for heavier duty service. Frames are engineered to give maximum strength and rigidity possible for machines of their class.

Both speed and direction are controlled by one handle on the column of the machine, grouped with other operating controls. Contourmatics provide a choice of coolant methods—flood coolant, air, or both combined for mist cooling. Companion heavy-duty contour machines are similar to the Contourmatics except that they do not have power-operated work tables and circulating coolant systems.—**DoAll Co.**, 254 N. Laurel Ave., Des Plaines, Ill.

For More Details Circle No. 491—Page 53

Circle 615 on Page 53→

FOR EVERY APPLICATION, THERE'S ONE CRANE OUTSTANDING...

IN PIPE MILLS: One of many P&H overhead cranes installed throughout the mill area, this P&H double-hook crane provides cat-quick but kitten-gentle handling of long and awkward loads of pipe. The twin-lift arrangement is typical of the complete attention P&H engineers give to custom-building cranes to your exact requirements. This means maximum crane efficiency with minimum operating costs because *your* crane is tailored for *your* job.

If you'd like more reasons why satisfied customers have made P&H the largest manufacturer of overhead cranes in the world, write for your free, information-packed copy of Bulletin C-42 to Dept. 111, Harnischfeger Corp., Milwaukee 46, Wisconsin.

P&H

HARNISCHFEGER

...quality and service for 75 years

OUR 75TH YEAR

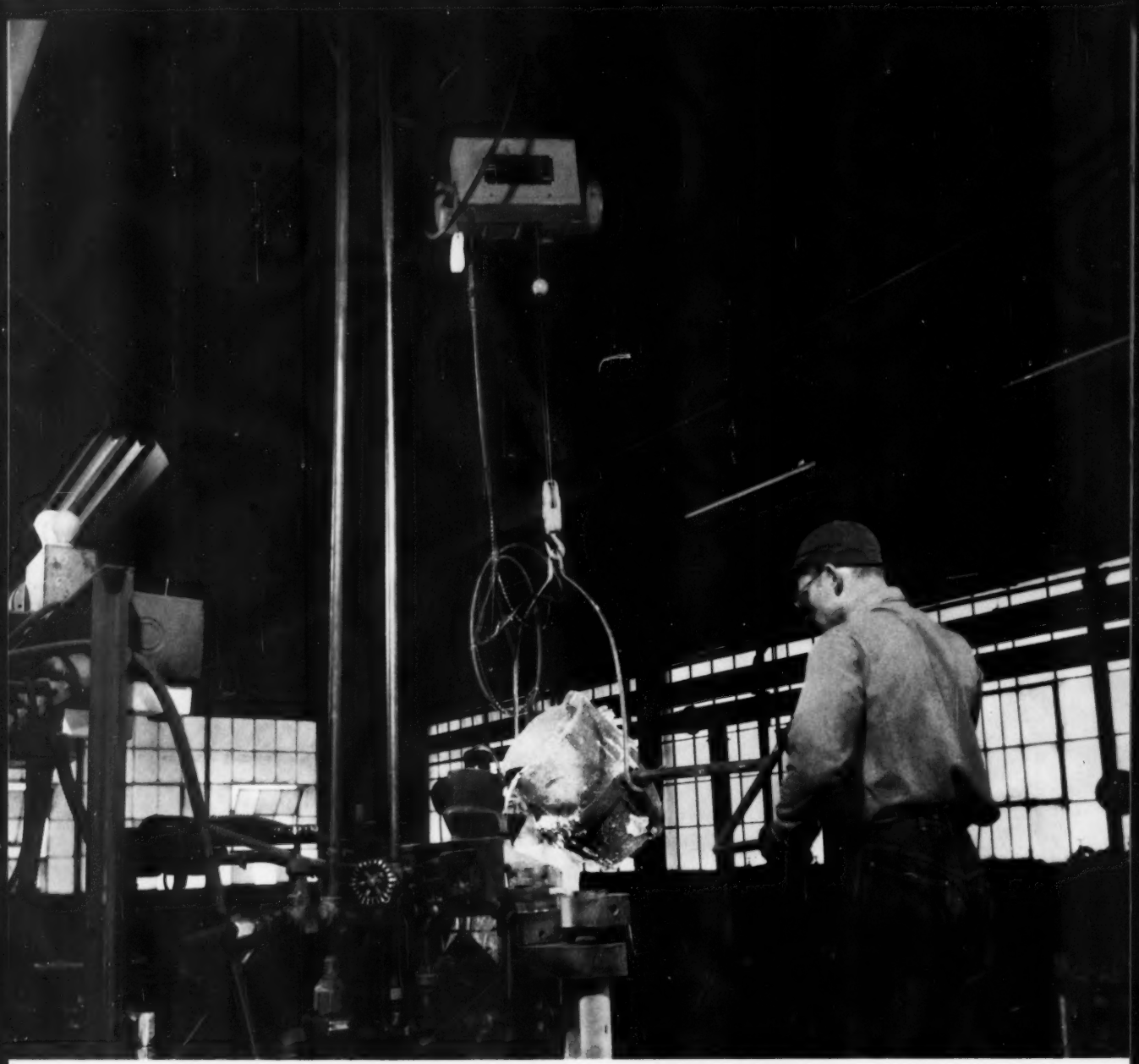


Photo Courtesy Quality Aluminum Castings Company — Waukesha, Wis.

POURING "HOTS" TAKES P&H PRECISION HOISTING

Putting ladles of molten aluminum "on the spot" for careful pouring is a P&H Zip-Lift's full-time job in this foundry . . . a job it handles with a mother's care. From furnace to mold this husky hoist answers every command with a sureness that pinpoints the Zip-Lift's close-spotting ability.

P&H Zip-Lift is "safety-built" too — made to include the positive safety features needed to protect workers from harm. One-hand, fingertip control provides instant response without drift — even under capacity loads. Control current is stepped down to a low 24 volts to protect operator against electrical shock. A double-safe dual brake system stops loads immediately . . . and either brake holds the whole load even if power fails. Limit switches guard against hoist abuse . . . cut maintenance.

Pleasantly enough, Zip-Lift accuracy and safety are priced for the shrewd buyer — starting as low as $200.

If precision safety and price are your buying yardsticks, you'll want a Harnischfeger Zip-Lift. It's fully explained in Bulletin H-20, yours for free from Dept. 203, Harnischfeger Corp., Milwaukee 46, Wisconsin.

P&H HARNISCHFEGER
...quality and service for 75 years

Industry Briefs

American Foundry Co. Inc., Indianapolis, wholly-owned subsidiary of Chrysler Co., became an operating plant of Chrysler's Forge and Foundry Div. on Dec. 31. The change will not affect personnel or employment. American operates two plants and employs about 1550 persons in the production of gray iron and aluminum castings.

Bickley Furnaces Inc., Philadelphia, has moved to a new office and factory building having over 10,000 sq ft of floor space. Their plant now is at 550 State Rd., Philadelphia 14, Pa.

Bar-Lin Steel Corp., 1630 S. Michigan Ave., Chicago, has made its first production and shipment of metallurgical iron in pig form, converted from scrap. The company's plant, formerly the Oliver Foundry, is in South Bend, Ind.

Standard Refractories Ltd., Hamilton, Ontario, has moved its head office and warehouse to larger facilities at the foot of Wellington Street. Additional equipment has been added to its manufacturing plant at 249 Hess St.

Ellis & Vans Foundry Inc., Gardena, Calif., has added a 610-sq-ft area above the 14,000-sq-ft plant to house executive offices, a customer conference room, the engineering department, and a reception room.

Bentonville Casting Co., Bentonville, Ark., is planning a $30,000 expansion program including a 6000-sq-ft addition for a new melting department and more molding and melting equipment. Construction is to be completed by February or March.

Conveyor Belt Service Inc., Duluth, is building a new plant at 13110 Enterprise Ave., Cleveland, Ohio, to repair and recondition conveyor belting. It will be in operation before the first of the year. Central States Industrial Supply Co., Cleveland, will serve as exclusive sales representatives for the company in the Cleveland area.

J. O. Ross Engineering Div., Midland-Ross Corp., Mt. Prospect, Ill., recently moved into a new 12,500-sq ft building at 320 S. School St. The midwest sales office of the Waldron-Hartig Div. also is housed in the new building.

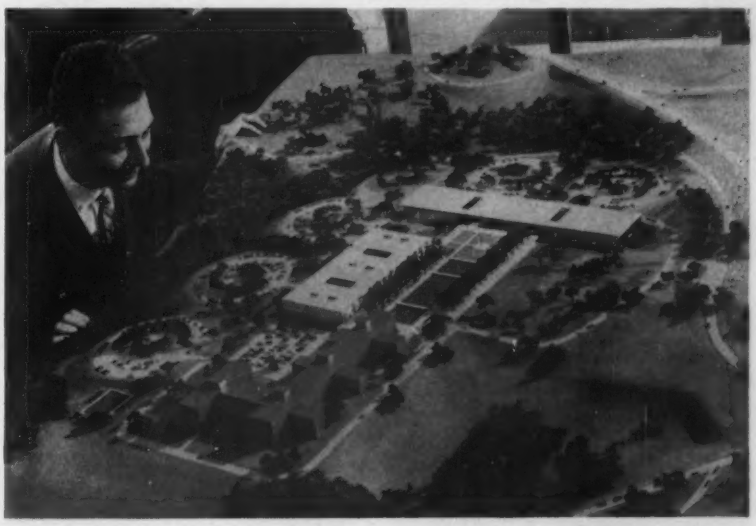
Patterns Inc. has moved into a new building at 2512 Farrington, Dallas, Tex. The building was erected by W. E. Killian, owner, who also was general contractor.

Los Angeles Steel Casting Co. has plans to build a new plant at 9703 South Norwalk Blvd., Santa Fe Springs, Calif. It would occupy 12 acres of an 18½-acre site.

Fer-Law Non Ferrous Foundry Co., 137 Bacon St., Waltham 54, Mass., was organized recently. President of the company is Julius J. Ferrari Sr., formerly foundry superintendent, Gorham Mfg. Co., Providence, R. I., and vice president and superintendent, Victors Foundry Inc., Guilford, Conn.

Homer Foundry Corp., Coldwater, Mich., sold its capital stock Dec. 1 to Jack Bean, president, Harold Schroeder, vice president, and Philip G. Smith, secretary-treasurer. The new owners also own and operate the Bay City Foundry Co., Bay City, Mich. Frank Cooke has been named works manager of Homer Foundry Corp.

Hamlin-Nagel Inc., Edwardsville, Ill. (metropolitan St. Louis), recently was formed as a foundry equipment and engineering service corporation. Company has 100,000 sq ft of warehouse and rebuilding facilities. Officers are Robert P. Nagel, president; Frank B. Hamlin, executive vice president; Charles E. Hall, vice president; and Linden A. Drda, secretary-treasurer.



R&D CENTER: Westinghouse Electric Corp. will construct a centralized 712,000-sq-ft research and development center at Churchill Borough, about 10 miles from downtown Pittsburgh. The center will be occupied by about 1750 scientists, engineers, and other key personnel from the company's laboratories and its patent department. Dr. S. W. Herwald, vice president, research, is shown here as he inspects a scale model which includes present facilities (dark building, center foreground) and planned center (two lighter buildings)

HOW To Do It

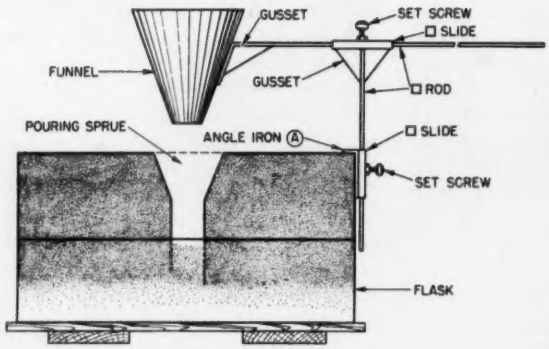
FOUNDRY will pay a minimum of $15 for each "How To Do It" idea submitted and published

Funnel Assembly Aids in Pouring Molds

By H. M. GRIFFOUL
San Jose, Calif.

THE STEEL FUNNEL assembly shown here is helpful in assuring correct pouring of molds in which location of the sprue is such that it is difficult to pour. Such is the case when the sprue is situated away from the edge of the flask. The bare steel funnel is used when nonferrous metals are poured; it is lined with clay when ferrous metals are poured.

Square steel rods are used in the funnel rig to facilitate proper alignment over the sprue. The rods are fitted freely in the slides so they can be adjusted easily and secured with the set screws. The piece of angle iron, A, measures 1 x 3 x 1/8 in. The vertical slide is welded to the wide side of the angle iron. The second slide is welded to the top end of the vertical rod and supported with gussets. The funnel is welded to the end of the horizontal rod.



During use, the angle iron support rests on the edge of the flask or jacket and is steadied by a man holding the horizontal rod. A second man does the pouring.

Northeastern Ohio Chapter, AFS, Sponsors Symposium

Northeastern Ohio Chapter of the American Foundrymen's Society will sponsor a management symposium on profitable operation of a foundry. It is scheduled for Case Institute of Technology, Cleveland, on Feb. 9, 16, and 23—three consecutive Tuesday evenings. All foundrymen and other interested individuals are welcome. There is no charge. Opening time for meetings is 7:30 p.m.

Technical chairman of the first session, "Profitable Foundry Operation," is Alexander D. Barczak, Superior Foundry Inc. Harry Figgie, partner, Booz, Allen & Hamilton, management consultants, will be the speaker.

Richard C. Meloy, marketing director, Gray Iron Founders' Society, will speak on "Profitable Foundry Marketing" at the Feb. 16 meeting. A. H. Hinton, Aluminum Co. of America, is technical chairman for the evening.

The last session will be devoted to "Profitable Foundry Environment." Speaker will be H. J. Weber, director, Safety, Hygiene, and Air Pollution, American Foundrymen's Society. Ernest E. Harkess, Cleveland Foundry, Ford Motor Co., is technical chairman.

Symposium chairman is James J. Schwalm, Archer-Daniels-Midland Co. Prof. John F. Wallace, Case Institute of Technology, is co-chairman.

Award Presentations Made at ASM Exposition and Congress

Major annual awards of the American Society for Metals were presented at the ASM's 41st National Metal Exposition and Congress, Nov. 2-6, in Chicago.

Rene Perrin, chairman and president, Ugine Steelworks, became the first Frenchman to receive the Albert Sauveur Award. Mr. Perrin was head of the group which developed the Ugine-Perrin process (steel Perrinization).

The Medal for the Advancement of Research went to John Leland Atwood, president, North American Aviation. Dr. Matthew A. Hunter, retired head of the department of electrical engineering and physics and the department of metallurgical engineering, as well as dean emeritus, Rensselaer Polytechnic Institute, was recipient of the 1959 Gold Medal.

Other awards included honorary memberships in the ASM for Edgar C. Bain, retired from research with U. S. Steel, and Earle C. Smith, chief metallurgist and research head of Republic Steel. Thomas F. Patton, president, Republic Steel, was made a Distinguished Life Member of ASM.

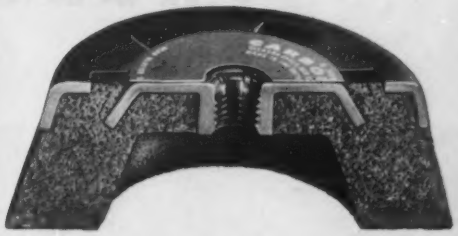
John E. Dorn, professor of metallurgy, Frank E. Hauser, assistant professor of mechanical engineering, and Philip R. Landon, research metallurgist, Lawrence Radiation Laboratory, all of the University of California, won the Henry Marion Howe Award for their joint authorship of a paper on "Deformation and Fracture of Alpha Solid Solutions of Lithium and Magnesium."

The ASM's $2000 Teaching Award was won by Dr. Walter A. Backofen, assistant professor of metallurgy, Massachusetts Institute of Technology.

NEW

cup wheels with "built-in guard"

for all rough grinding applications



- *extra strong*
- *break resistant*
- *positive mounting*
- *no work interference*

Here's a new, portable cup wheel by CARBORUNDUM that offers outstanding safety and performance features for all rough grinding applications in steel mills, foundries, welding shops, etc. The "built-in" guard consists of a one-piece combination steel back and prong-type bushing molded into the fast-cutting resinoid bond. It is easy to mount, eliminates heavy conventional safety guards, and does not interfere with the work piece.

ESPECIALLY DESIGNED FOR USE IN

- *STEEL MILLS*
- *FOUNDRIES*
- *WELDING SHOPS*

WRITE for more information about portable Cup Wheels with "built-in guard" form A-1523.

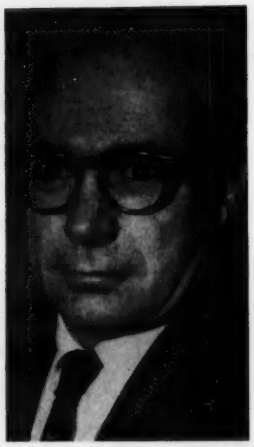
SEND your request to The Carborundum Company, Dept. **F-81-02**, Niagara Falls, New York.

CARBORUNDUM

Circle 607 on Page 53

Brass Foundry Enters

STEEL CASTINGS PRODUCTION



By J. M. KADERLY
Chief Production Engineer
Fulton Sylphon Div.
Robertshaw-Fulton Controls Co.
Richmond, Va.

● WHEN a brass and bronze foundry undertakes to produce carbon steel, stainless steel, and Monel castings, it faces a host of new problems. Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Knoxville, Tenn., which has operated a brass and bronze foundry since 1914, recently made this transition.

After World War II, a demand arose in the nuclear and chemical industries for a line of packless valves made from carbon steel, Monel, and corrosion-resistant stainless steels. Eventually, this demand resulted in a decision to pour such ferrous castings at the Fulton Sylphon Div. plant in Knoxville.

Induction Melting — In June, 1957, induction melting equipment was installed. It consists of one 250 and two 500-lb furnaces so connected that only one furnace can be operated at a time. The 250-lb furnace is used to melt stainless steels and Monel, and one 500-lb furnace is used to melt carbon and carbon-moly steel. A zircon ram-up lining is used on both. The average life of the zircon lining is approximately 10,000 lb on the 250-lb furnace and 50,000 lb on the 500-lb unit. The other 500-lb furnace is used on bronze, where capacity permits, because of the low stock loss in this unit.

Uniformity of quality is assured by the use of 304 low-carbon ingot (0.03 per cent C max), nickel, ferroalloys, and well identified returns not exceeding 60 per cent of the charge.

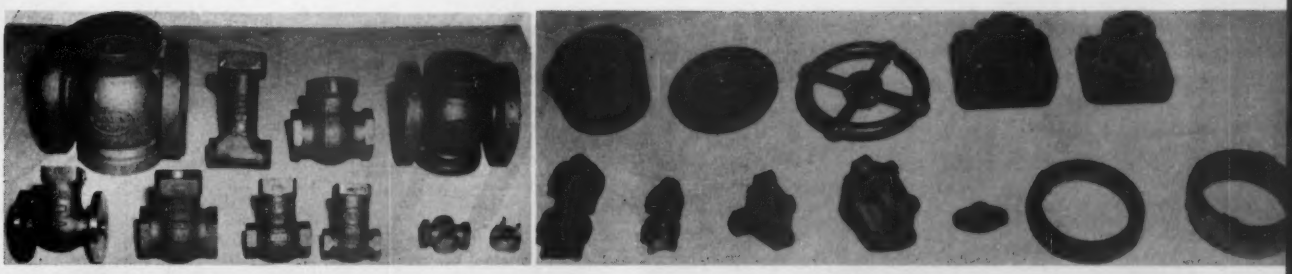
When a melt is ready, the entire 250-lb furnace charge is tapped into a well preheated teapot ladle; the 500-lb unit also is tapped into the 250-lb ladle. When metal from this furnace is poured, power is maintained on the remaining charge to hold proper temperature and provide the stirring action of the induction current, which aids in control of gas and slag.

Pouring from a 250-lb ladle is unusual, but its effectiveness is credited to several factors. For example, a well preheated ladle is provided by a unique method of heating. This preheating equipment is adjacent to the furnaces, and the short distance from the furnaces to the pouring area is covered quickly with a mechanical pouring crane.

The preheaters are made of masonry with doors which slide up and are counterbalanced. Natural gas burners in the ceilings heat these units. Ladles are completely enclosed, and the gas flame is directed inside them. This arrangement produces quick, uniform heating to a point approaching the pouring temperature. As an accompanying illustration shows, the ladle is placed on a cart, and both are pushed into the preheater.

Fume Control — Fume control is accomplished with roof fans and a mobile exhaust system on the pouring operation. The exhaust system consists of a duct arrangement which is fastened to and travels

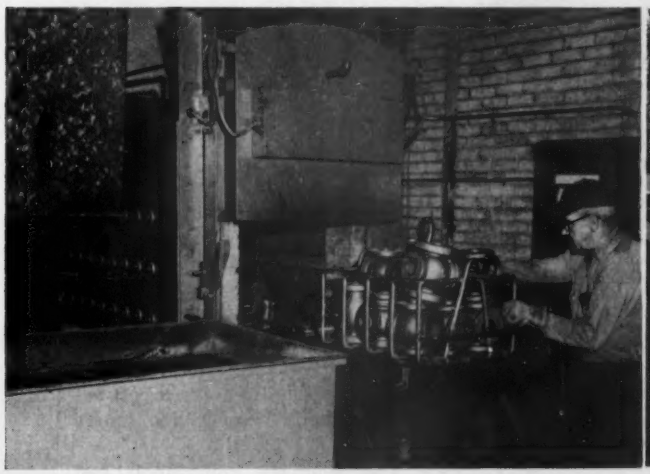
Stand grinders in the cleaning room. Gates and risers are removed by cut-off wheels and saws



Typical valves and fittings being produced in the ferrous foundry department. They include carbon and stainless steel as well as Monel parts

Hydraulically operated rollover machine used in producing larger valves taking 30 x 30 in. flasks

Mobile exhaust system provides fume control by traveling with ladle as it moves from furnace



Heat treating furnace being charged with load of valves. Various types of treatment are performed

Special arrangement is provided for preheating ladles by gas burners before filling with metal

along with the overhead electric crane. The crane is operated by pushbuttons and is electrically powered in all directions. An illustration shows how the exhaust system is designed so that it travels with the ladle.

Molding — Molds are made on eight jolt-squeeze type machines and one rollover machine. The green molding sand consists of AFS fineness 90 silica sand, southern bentonite, and a carbonaceous additive. This same green sand is used for both the nonferrous and ferrous castings. On heavier ferrous castings, it has been found advantageous to use a facing sand consisting of AFS fineness 50 silica sand. Additives are the same as in the normal mix.

An unusual arrangement is employed for rollover work, which is used for valves requiring flask sizes 30 x 30 x 12 in. This arrangement became necessary when an old combination jolt rollover machine purchased in 1951 required replacement. It also was necessary to roll over work which was beyond its lift capacity. A cost survey revealed that investment in new equipment of sufficient size was not sound for the small-lot production involved.

That replacement problem was solved by the installation of hydraulic cylinders, a hydraulic pumping unit, and proper valving arrangements. The new hydraulic system gave ample lifting power for the rollover work. A jolt machine was purchased which is situated adjacent to the rollover machine.

After a flask has been filled with sand and rolled over, flask and pattern are transferred to the jolt machine. The pattern then is returned to the rollover machine and fastened down with quick-action clamps. Rollers are built into the bed of the machines to facilitate the transfer. Because the cope and drag system is used, several drags are made, and the pattern then is changed to run a like number of copes.

Cores—CO_2 cores are used exclusively for the ferrous castings because they provide the necessary permeability. The CO_2 method also reduces core equipment costs since cores are produced in small lots.

Core washes seldom are necessary on the bronze castings, but they are imperative on all ferrous castings to prevent excessive burn-in. Considerable time was spent in working out the proper wash. Water could not be used, of course, since it would soften the CO_2 cores. A zircon wash was found to be satisfactory for use with the ferrous castings.

Cutoff — Cutting off gates and risers on ferrous castings presented a difficult problem. Abrasive cutoff machines are used on the nonferrous castings, but finding the most efficient abrasive wheel for ferrous castings required much investigation. A satisfactory type was found, however, and wheel cost averages about 3 cents per square inch.

The relatively high cutoff cost has resulted in greater effort to reduce the sizes of gates and of riser necks. On as-cast weights above 50 lb, riser necks have been reduced by the use of Washburn cores. A

ATTENTION ALL GRAY IRON FOUNDRIES . . .

Now! HOT METAL NEW U. S. "SKLENAR" REVERBERATORY MELTING FURNACE

LOOK AT THE RECORD

Here's authentic performance data on 500 lb., 1000 lb., and 2000 lb. U. S. "Sklenar" Furnaces equipped with straight gas, oil, or dual fuel burners (no addition of fuel oil necessary when firing with gas), all three furnaces melting gray iron to high temperature for pouring light and difficult castings, with full charges consisting of one half pig iron, with balance in gates, risers and ordinary purchased scrap.

MELTING DATA

500 LB.	1000 LB.	2000 LB.
Time: 30 min.	Time: 40 min.	Time: 45 min.
Oil Used: 11½ gals.	Oil Used: 19 gals.	Oil Used: 40 gals.
*Gas Used: 1400 cu. ft.	*Gas Used: 2800 cu. ft.	*Gas Used: 5250 cu. ft.

*1030 BTU

Really hot metal . . .

of sufficient temperatures to pour light and difficult castings of excellent structure and machinability, with practically no rejects—that's the money-saving story behind the performance record of the revolutionary new U. S. "Sklenar" Reverberatory Melting Furnace. Innovations in combustion, design and construction, with patented features that contribute to faster melting, built-in economy of operation, and lower maintenance costs, are all yours in tomorrow's method of melting metals today!

Available in sizes ranging from 500 to 2000 lbs.—iron, brass and bronze (⅓rd these capacities for aluminum melting).

Get free bulletin. Send today for valuable and informative brochure.

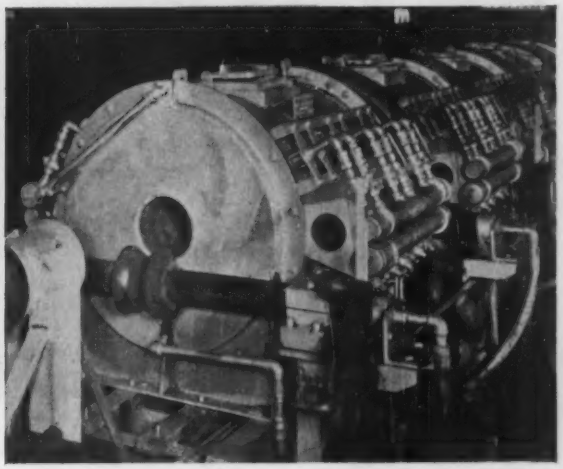
For over 40 years builders of the well-known and favorably regarded U. S. Rotary Melting Furnaces.

U. S. SMELTING FURNACE CO.
BELLEVILLE, ILLINOIS

Electrode ports of this electric furnace roof are formed of B&W castable. B&W Kaocast or Kaocrete-32 can be successfully used, depending on severity of service.

High thermal release burner block is cast of B&W Kaocrete-32. Both Kaocrete-32 and Kaocast are used for burner blocks and other services in many other furnaces.

Nose arch of walking beam type furnace for heating forgings is made of Kaocast, B&W's 3000 degree castable. Kaocast is also used in forming complete forging furnaces,



This high speed barrel type heating furnace is typical of many which are completely lined with high temperature B&W Kaocast.

How B&W refractory castables solve high temperature problems

The higher temperatures in industrial processes have called for refractory castables that will stand up in these severe services. B&W offers two extremely durable, high temperature refractory products—Kaocrete-32 for applications up to 3200 F, and Kaocast with a 3000 F use limit. Both have high strength, unusual volume stability and excellent resistance to spalling and slag attack. Investigate B&W *specialized* refractory castables for solutions to your high temperature problems.

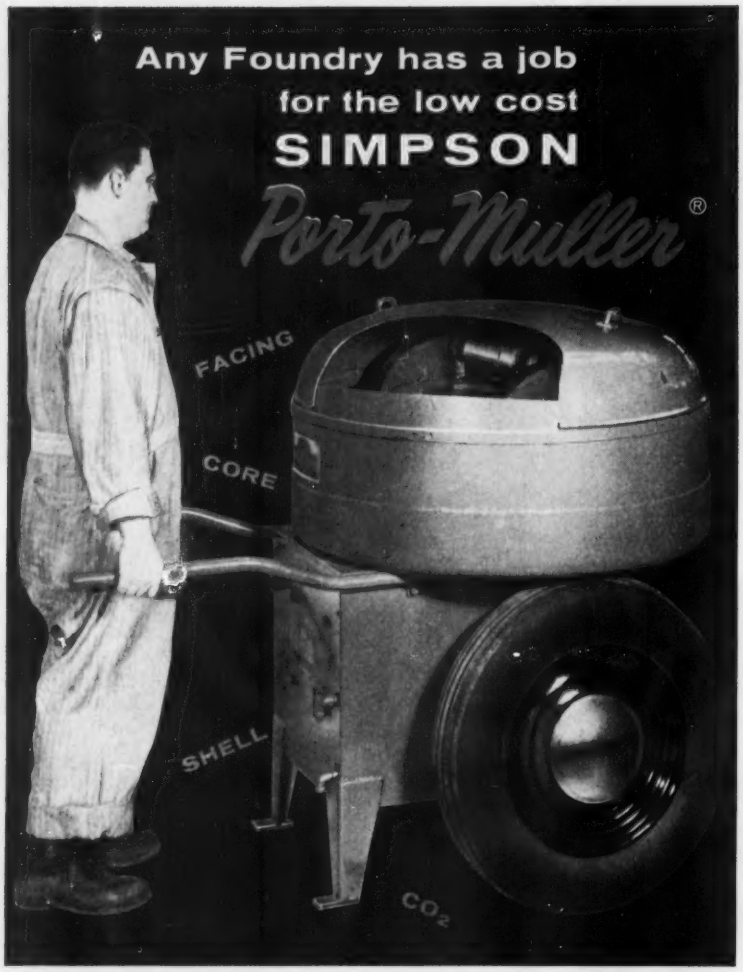
B&W Bulletin R-35A gives additional information on versatile B&W refractory castables. Write for copy to The Babcock & Wilcox Company, 161 East 42nd Street, New York 17, N.Y.

R620R

B&W THE BABCOCK & WILCOX COMPANY

REFRACTORIES DIVISION

B&W Firebrick, Insulating Firebrick, and Refractory Castables, Plastics, Ramming Mixes, Mortars, and Ceramic Fiber.



Mix any sand anywhere in the shop!

Here's a 100% portable muller that comes fully equipped—ready to start mulling. No hoist is required. Use it for BIG jobs in small foundries or small jobs in BIG foundries. Economical 3 HP drive permits greatest amount of work for lowest operating costs. All power is used to *mix sand*. Users report considerable savings in binders and core oil due to controlled, intimate blending and adjustable muller pressures.

"My molders tell me that it is a pleasure to work in a sand heap mulled with our Simpson Porto-Muller. Also, it is easy for one worker to move it around the foundry from one sand heap to another.

"I would sincerely recommend this Simpson Porto-Muller to foundries that wish to take the Muller to the sand heap instead of the sand heap to the Muller."

(Bronze and Aluminum Foundry, Illinois)

Write for a copy . . .

NATIONAL ENGINEERING COMPANY

646 Machinery Hall Bldg., Chicago 6, Illinois

friction bandsaw has been found satisfactory on cuts under ¾ in. thick. Use of the abrasive wheel and the friction saw eliminates the need for additional grinding where the cutoff has been made.

Heat Treatment—For maximum corrosion resistance, all stainless steel castings are heat treated at 1950 to 2050° F. Immediately after the castings come from the furnace, they are quenched in water to retain the carbon in austenite. Most of these are poured of ASTM A 296 grades CF-8C and CF-8.

Carbon and carbon-molybdenum alloy steel castings are normalized for 1 hour per inch of cross section at 1650° F. Chromium-molybdenum is normalized at 1700° F for 1 hour per inch of cross section. Since most of the work has a cross section of 1 in. or less, temperature is maintained for 1 hour.

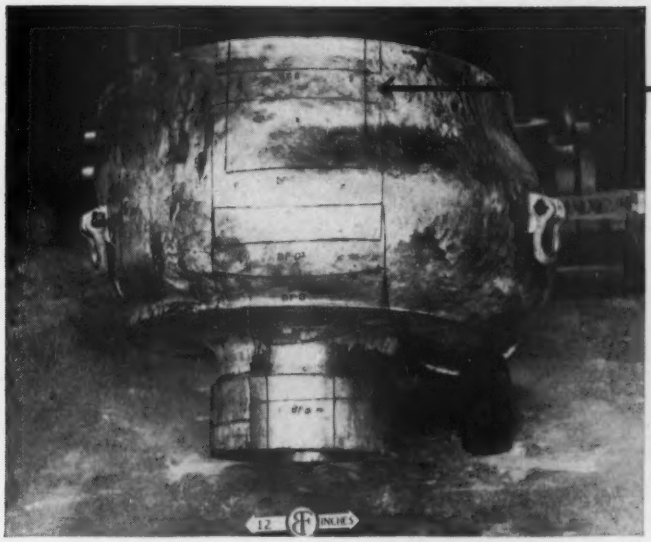
Carbon-molybdenum steel castings are tempered by reheating to a minimum of 100 degrees above their anticipated operating temperatures, but to not less than 1100° F. They are held at the elevated temperature for 1 hour per inch of cross section, removed from the furnace, and allowed to air cool. The furnace will control within ±10 degrees at any setting.

Ductile Iron Society Holds Fall Meeting in Detroit

The Ductile Iron Society held its fall meeting in Detroit recently, following a meeting of the board of directors of the society. A substantial delegation from California was present, including J. R. Ludwig, who reported on an area meeting which he and President Robert S. Thompson had held recently.

President Thompson stressed the importance of quality and cost control and the advantages of co-operative research and study of operating and production problems. Vice president William Beatty reported on the presentations at a summer seminar on ductile iron in New York.

James H. Lansing, the executive secretary of the society, led a discussion of quality control methods with those in attendance contributing suggestions based on their experience.



Marks on the casting show positions of the films during exposure. Above, radiograph of the area indicated.

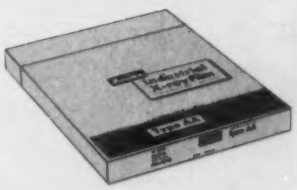
5 tons of stainless casting... Radiography goes over it inch by inch

Pumping radioactive water calls for pump castings that are flawless. Bonney-Floyd Company, one of the largest producers of steel castings for nuclear power use, makes sure of quality through radiography with Kodak Industrial X-ray Film.

Made of CF8(18-8) stainless steel, this casting will become the casing for the primary coolant pump for a large land-based nuclear power plant. Since this pump will handle radioactive water, utmost quality is required. To be sure of this quality, the Bonney-Floyd Company radiographed the entire casting, using their 24-Mev Betatron and Kodak Industrial X-ray Film, Type AA.

This is another example of how radiography provides assurance that only high-quality work is delivered to the customer. It is a way reputations for fine work are built.

You should take advantage of radiography. If you would like to know how it can work profitably for you, talk it over with an X-ray dealer or write us for a Kodak Technical Representative to call.



Read what Kodak Industrial X-ray Film, Type AA, does for you:

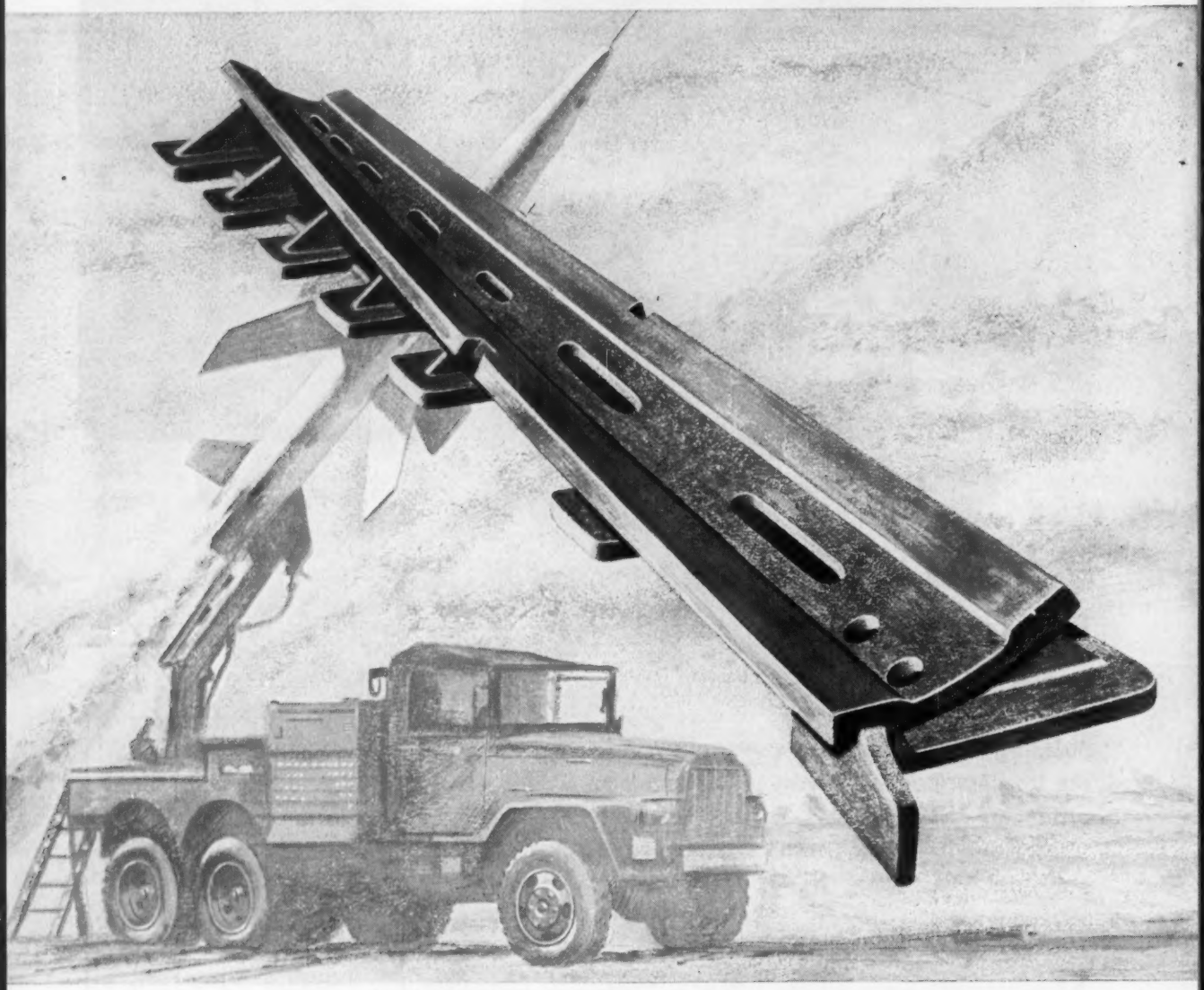
- Speeds up radiographic examinations.
- Has high film contrast, giving increased detail visibility and easy readability at all energy ranges.
- Provides excellent uniformity.
- Reduces the possibility of pressure desensitization under shop conditions.

EASTMAN KODAK COMPANY
X-ray Division **Rochester 4, N.Y.**

Kodak

Circle 611 on Page 53

How the Foundry Industry serves America . . . #1 of a Series



IRON CASTING REDUCES COST OF MISSILE LAUNCHER TRACK BY 41%

This important contribution to the guided missile industry was accomplished by replacing the nine independent parts formerly used with one integral high-strength iron casting. Not only was a substantial saving effected, but the cast iron track with its much greater dimensional stability assured the exact alignment so vital to successful missile launching.

This is a typical example of the improved performance at lower cost that can be achieved by incorporating modern iron castings into sound, modern industrial design.

Hanna is proud to be part of this great industry and will continue to provide foundries with all regular grades of pig iron . . . foundry, malleable, Bessemer, intermediate low phosphorus, as well as HANNATITE® and Hanna Silvery . . . in the same high quality and to the same high standards that have made Hanna the best known name in iron.

Facts from files of Gray Iron Founders Society

HANNA
THE BEST KNOWN NAME IN IRON

THE HANNA FURNACE CORPORATION
Buffalo • Detroit • New York • Philadelphia
Merchant Pig Iron Division of
NATIONAL STEEL CORPORATION

Circle 612 on Page 53

COKE PRODUCERS PROMOTE IRON CASTINGS

Will Sponsor Nine Films in Co-operative Program

To promote increased use and sale of iron castings, the American Coke & Coal Chemicals Institute, Washington, on behalf of the entire American merchant coke industry, will sponsor a new series of promotional, educational, and engineering films developed and to be produced by the Gray Iron Founders' Society, Cleveland.

The extensive three-year film program accepted by the institute calls for three color-sound motion pictures and six color-sound strip films.

Commenting on this new co-operative program, GIFS President Albert M. Nutter, E. L. LeBaron Foundry Co., Brockton, Mass., cited the favorable results of promotional activities being conducted by competitive industries.

Promotion Develops New Products

"For instance, the prime force behind the aluminum industry's recent and remarkable growth," says Mr. Nutter, "is the research, development, and sales promotional work being conducted by the big three aluminum ingot producers. New products so developed mean increased business for all aluminum fabricators which means increased sales of ingots by the suppliers."

Bernard M. Fitzgerald, executive secretary of American Coke & Coal Chemicals Institute agrees with Mr. Nutter's philosophy. He points out that today the foundry industry is the principal market for their coke. Accordingly, promoting the sales of iron castings is a logical move for the coke industry if it wishes to preserve and increase its sales position in the future.

Donald H. Workman, executive vice president, Gray Iron Founders' Society, says that the new film program is another important forward step in broadening the society's overall marketing program. He reports that various GIFS surveys and sales contacts with customers all point to the need for more solid educational work among buyers and potential buyers of castings.

"The greatest want for facts on casting design, properties, and specifications is found among engineers, and the engineering students who will be designing the products of the future," Mr. Workman stated. He added that society membership is enthusiastically behind the new marketing activities. He specifically mentioned the success of a recent series of member sales training clinics and customer casting design clinics which were conducted in three score cities from coast to coast.

Referring to a recent "member interest survey" Mr. Workman reports that 87 per cent ask for society-sponsored research, 99 per cent want more product development efforts, and 97 per cent of the members call for stepped-up sales promotion and customer education. The latter aim ties in precisely with the new film program.

The film series will assist engineers and designers in fully utilizing new developments in the castings industry. Many of these modern developments have not been understood or utilized fully because of their relative complexity.

Color Movie To Begin Series

The first year's film production will lead off with a general interest, 30-minute color movie to stimulate new interest in the advantages of the castings process and products.

Another color movie, "Straight Line to Production—the Castings Process," will be produced in 1961. Its purpose will be to clarify understanding of the various castings processes and to assist designers with design concepts, economies of the casting process, reduction of engineering time, etc.

Also in the second year, the society will produce three film strips covering the technical material, an introduction to metallurgy, properties, etc. Balance of the program will involve a third color-sound motion picture, "Heat Treatment of Gray Iron," which will illustrate how properties can be extended and improved by heat treatment. The third year, three more strip sound films will be produced. They will cover casting design and pattern equipment economies in detail. Academy - McLarty Productions, Buffalo, will produce the films for the Institute.

In the interest of the American foundry industry, this ad (see opposite page) will also appear in

Steel
Iron Age
Foundry
American Metal Market

FREE!

REPRINTS OF THIS AD WITH YOUR FIRM'S SIGNATURE

If you would like to have reprints of this ad to mail to your customers and prospects, let us know. Reprints will have no Hanna product message or signature, but will be imprinted with your firm name and address. Absolutely no obligation. To order your reprints, fill in and mail the coupon below.

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Detroit 29, Michigan

Please send me_____ reprints of Ad No.
(No.)
____ of your Foundry Industry Series.
Imprint as follows:

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Send reprints to:

NAME_____

I understand there is no charge for this service.

Circle 612 on Page 53

Members of the SFSA Technical and Operating Committee at the Conference. Top row: Dr. R. W. Zillman, Philip McCaffery, G. L. Stroppel, Paul von Colditz, P. J. Neff, J. F. Oettinger, W. C. Struchen. Seated: E. J. Bewig, Dale L. Hall, and E. A. Short

Steel Founders Hold 14th T & O Conference

● THE Steel Founders' Society of America's 14th annual Technical and Operating Conference, held in Cleveland Nov. 9-11, attracted 483 representatives from 121 steel foundries.

Highlighting the three-day affair was an exchange lecture by Dr. Arthur H. Sully, director, British Steel Castings Research Association, Sheffield, England. Dr. Sully's talk was on "Dust Control and Noise Abatement."

Of particular interest to the technical and operating audience was an all-day session on the "Fundamentals of Steel Foundry Sands." The session was conducted in the manner of a school course with six lectures by authorities in the field.

Topics included "Characteristics of Sands," "Constitution and Significance of Clays and Bentonite," "Essentiality of Water Additions," "Qualities of Organic Bonding Materials," "Mulling and Shaping of Molding Sands," and "Effect of Molten Steel on Sands and Molds." Prof. J. F. Wallace, Case Institute of Technology, and Prof. W. G. Lawrence, Alfred University, participated, along with four industry representatives.

SFSA officials said that the society expects to offer a book summarizing the sessions on the "Fundamentals of Steel Foundry Sands" sometime next year. A book containing the lectures presented at the 1958 T & O Conference on "The Flow of Steel in Molds" is available from the society at $3.50.

In addition to the sessions on steel foundry sands, lectures were given on steel production and treatment and cleaning room processes and problems. A symposium on molding methods was held during the second day of the conference.

Several professors, representing colleges participating in the Foundry Educational Foundation program, attended the conference for the first time this year as special guests of the society. Representatives of several branches of the military also attended the sessions.

R. L. Gilmore, president of SFSA and president of Superior Steel & Malleable Castings Co., Benton Harbor, Mich., presented Safety Award Certificates to representatives of 52 award-winning foundries. Dale L. Hall, chairman of the national Technical and Operating Committee and works manager of the Oklahoma Steel Castings Co., Tulsa, Okla., was general chairman of the conference.

Left to right: C. W. Briggs, SFSA technical and research director; Dr. Arthur H. Sully, director, British Steel Castings Research Association; R. L. Gilmore, society president; Dale L. Hall, conference chairman

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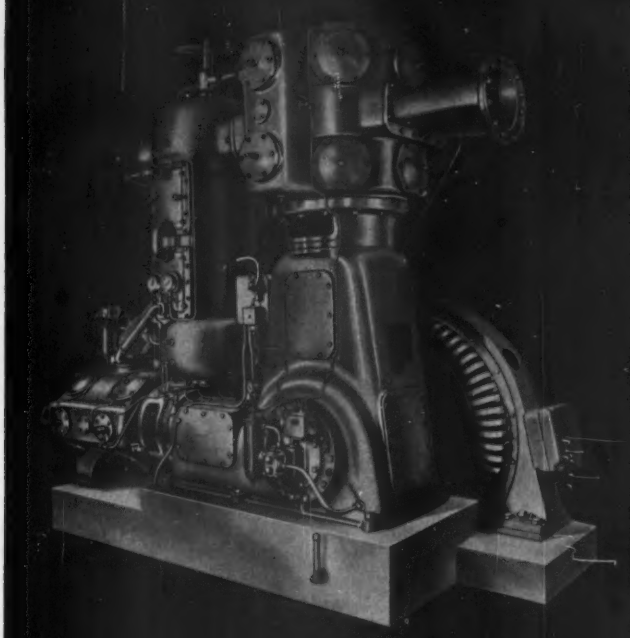

- Can compressed air be produced more efficiently and economically?
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Foundry Developments

By EDWIN BREMER

Metallurgical Editor

Pushbutton Molding

REPORTS indicate that in four to six months, equipment will be on the market for producing molds automatically on sandslingers. Control of the operations will be accomplished by magnetic tape programming. It is claimed that the programming equipment is much lower in cost than similar other equipment, and does not require the use of computer techniques and equipment. Accordingly, it is said that tape preparation can be carried out by skilled machine operators rather than by specially trained, programming technicians. Development project is being carried on jointly by Beardsley & Piper Co., Chicago, and Micro-Path Inc., Inglewood, Calif.

Girls' Best Friend?

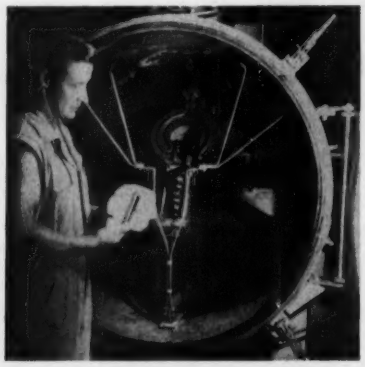
DETAILS of one of its major scientific and engineering achievements, the process for making diamonds, recently were revealed by General Electric Research Laboratory. The man-made diamonds are produced by use of a metal catalyst in combination with pure graphite. The catalyst may be chromium, manganese, nickel, tantalum, etc.

The graphite and catalyst are placed in a cell formed of porphyllite and subjected simultaneously to pressures of 800,000 to 1,800,000 psi and temperatures from 2200 to 4400° F. Diamonds are reported to form under those conditions in a few minutes. They are 80-mesh and finer in size, and are used industrially in cutting, grinding, and polishing operations.

Skull Practice

SKULL-TYPE, vacuum arc-melting furnace shown in the accompanying illustration and just placed in operation at Battelle Memorial Institute, was used to mold the uranium monocarbide reactor fuel element being inspected by Walter J. Hildebrand of the institute's reactor fuel staff. The specially equipped furnace makes it possible to cast reactor fuel elements in their final form.

Contamination of reactive and refractory metals cast in the furnace is kept to a minimum because the metals are melted in water-cooled skulls of the same material. Temperatures of over 6000° F can be attained in the furnace, which will



be employed in studies of uranium, zirconium, columbium, chromium and tantalum.

Improves Iron Quality

AN ARTICLE in the Nov. 5, 1959, issue of *Giesserei* (Duesseldorf, Germany), entitled "Die Schuettelpfanne—ein neues metallurgisches Hilfsmittel unter besonderer Beruecksichtigung der Hertellung von Hochwertigem Gusseisen" by Sven Eketorp and Bo Kalling discusses the application of a shaking ladle for improving the quality of pig or cast iron.

The ladle is mounted on a table on which it is rotated at 70 rpm with an eccentricity of about 2.5 in. Desulfurization, recarburization, alloying, and reduction of silicon and vanadium can be accomplished during the shaking period by suitable additions. Sulfur reduction from 0.213 per cent to 0.032 per cent was accomplished with addition of 1.5 per cent lime in 10 minutes with a temperature loss in the range of 175° F. Molten iron also may be treated in the ladle with oxygen lancing to reduce Si and V with slight reduction in C.

Alloy Has Muscle

DEVELOPED in the Research Division of New York University's College of Engineering is a new titanium alloy which is described as far superior in strength, ductility, and toughness to any comparable alloy now commercially available. Alloy results from three years' research by Dr. Harold Margolin and Paul Farrar in a project sponsored by Watertown Arsenal. It has a nominal composition of 6 per cent Al, 6 per cent V, 2 per cent Sn, 0.5 per cent Fe, 0.25 per cent Cu, and 85.25 per cent Ti. Material is reported to have a yield strength of 200,000 psi, 8 per cent elongation, 18 per cent reduction of area, and an impact strength of 8 ft-lb at 33.8 to 104° F.

Steel Deoxidation

CERTAIN steel foundries have indicated that ladle deoxidation with aluminum plus a silicon-titanium-calcium-iron alloy which controls formation of grain boundary inclusions, causes an increase in yield strength of the steel without appreciable loss in ductility according to Vanadium Corp. of America. Other reported advantages are better fluidity at equal temperature, fewer leaks around stoppers of bottom-pour ladles when pouring medium-manganese steels, and better machinability of castings. Usual deoxidizing procedure is to add 2¼ to 2½ lb aluminum per ton to the ladle shortly after the start of the tap, followed closely by 3 to 4 lb per ton of the Si-Ti-Ca-Fe alloy, and completing the additions before appearance of the slag. The alloy contains 50 Si, 10 Ti, 6 Ca and remainder Fe.

"We've cut magnesium alloy usage in half"

Attention ductile iron producers who use the "plunging" treatment to get higher recoveries and better magnesium control: UNION CARBIDE METALS offers two alloys for this treatment—"EM" magnesium-ferrosilicon (10 per cent magnesium) and "EM" alloy 55 (30 per cent magnesium). Both are low-cost sources of magnesium and are specially sized for plunging into acid- or basic-melted iron.

These alloys promote higher as-cast ductility and counteract elements which hinder formation of the spheroidal graphite structure. In addition, plunging these alloys gives you magnesium recoveries up to 50 per cent, better structure control, less pyrotechnics, and lower costs. For further information, contact UNION CARBIDE METALS, pioneer producer of magnesium-silicon alloys for ductile iron.

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Circle 614 on Page 53

J. H. Morison, left, newly elected president, presents plaque to R. R. Miller, immediate past president, for his service to the ICI

J. H. Morison, left, presents the ICI Whale award to Leo Carr, center, and R. H. Herrmann, for their work in preparing the institute's new book on investment castings

Investment Casters Discuss

Technology . . . Marketing . . . Costs

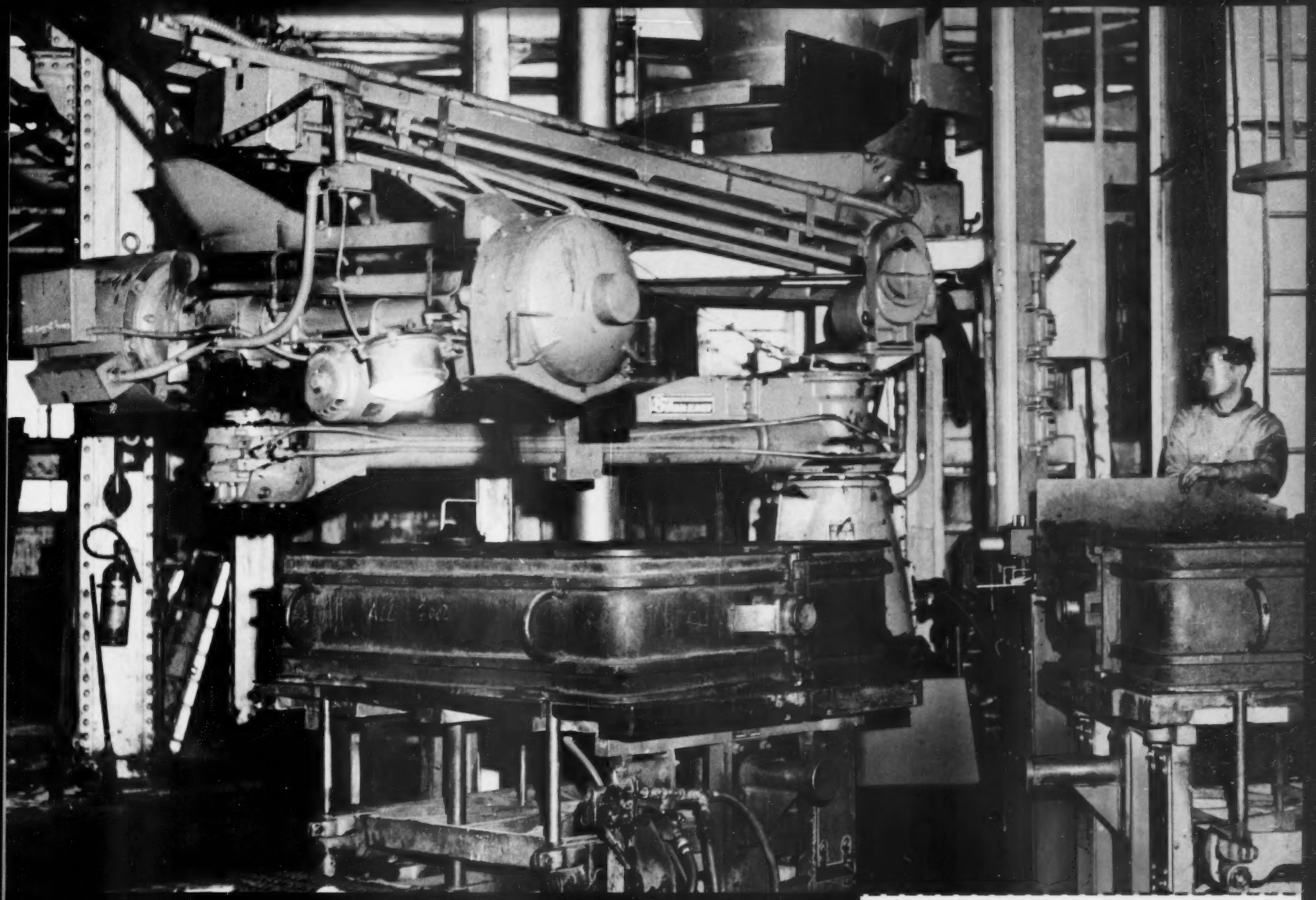
By ROBERT H. HERRMANN
Associate Editor

● INVESTMENT Casting Institute's seventh annual meeting, held Nov. 3-4 at La Salle Hotel, Chicago, drew an attendance of 70.

The business session featured a review of ICI activities and accomplishments by R. R. Miller, Precision Metalsmiths Inc., Cleveland, retiring president of the institute; presentation of the ICI's new book, *How to Design and Buy Investment Castings*, by L. E. Carr, Precision Metalsmiths Inc., book committee chairman; recommendation of the board of directors for the 1960 program by J. H. Morison, Hitchiner Mfg. Co., Milford, N. H., incoming ICI president, and a discussion of

Newly elected officers of the ICI, seated left to right, are: R. E. Gray, vice president-management section; J. H. Morison, president; R. F. Waindle, vice president-technical group, and L. R. Schwedes, treasurer. New directors, standing left to right, are: W. A. Dubovick, J. H. Cadieux, R. R. Miller, and P. J. Nilsen. R. B. Thys, who also was elected to the board of directors, is not shown

Circle 616 on Page 53→



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Of course, Hydra-Slinger provides the famous Sandslinger quality—hard, uniform ramming regardless of flask size or depth—true-to-pattern molds—improved casting finish. The flexible Hydra-Slinger can be used with Rol-A-Draw and Roto-Mold turntable or loop conveyor to meet varied production requirements. Automatic Hydra-Slingers are available for repetitive work.

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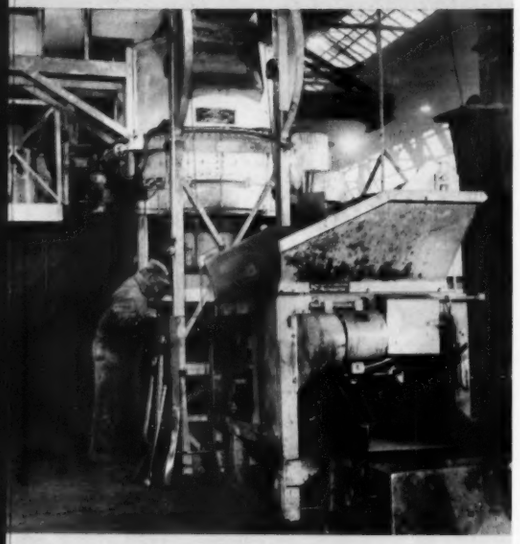
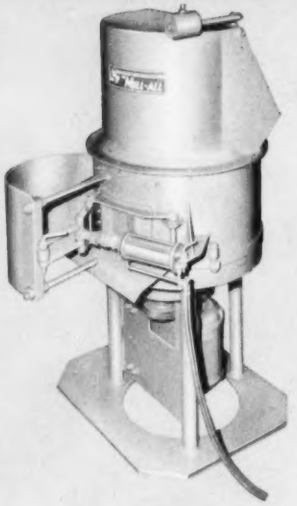


Sand Control for Jobbing Foundries!

Jobbing foundries need no longer be hampered by the inadequacies of floor sand-cutting methods. Beardsley & Piper Speedmullor-Preparator Units provide complete sand conditioning and mulling for foundries where such sand preparation was formerly not feasible. Here are all the advantages of complete conditioning and mulling—throughout the foundry—at a very moderate cost. These modern space-saving units provide a fully controlled sand practice at a cost well within the budget of the average small jobbing foundry.



Low-Cost, Compact Mulling Unit!

The Mull-All has been especially developed to fill the pressing need for a low cost, highly productive, but flexible unit. Here is a complete ready-to-operate-package with all auxiliary equipment and controls to assure batch-after-batch uniformity. The Mull-All is equally effective in the preparation of any type of facing, molding or core sand.

The capacity of this compact, highly productive unit is approximately 6,000 pounds per hour. Average mulling cycles are three minutes. The Mull-All is also available for low cost preparation of shell sand.

Mulbaro—the Really Portable Mullor!

Real portability with fast, thorough preparation—that's the Mulbaro. Mulled sand is moved to the molder or coremaker in the same barrow used for mulling. The efficient Mulbaro can be used with two or more barrows—after one batch is mulled and moved away, a second barrow can be placed in mulling position for a new batch. The high-agitation plow design and hemispherically shaped barrow bowl insure complete mulling of any type of core, molding, or shell sand in short time cycles.

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plans for future technical activity by Jack Keverian, General Electric Co., Schenectady, N. Y.

Technical programs are to be expanded and will include the organization of meetings and seminars, enlargement of the intra-industry research program, and the editing of ICI's *Technical Review*. The activities will be under the direction of a full-time technical director now being sought by the ICI.

Allied membership, a new category, has been established by the institute and is available to users of investment castings. Allied membership is available on a company or individual basis but only to companies and individuals from companies not qualified for regular membership. Members in the new category will be eligible to attend all ICI technical meetings and may participate in the intra-industry research program. They also may work on technical committees and participate in study groups.

Elected officers and directors for the coming year, in addition to Mr. Morison as president, are R. E. Gray, Gray-Syracuse Inc., Manlius, N. Y., vice president-management section; R. F. Waindle, WaiMet Alloys Co., Dearborn, Mich., vice president-technical section, and L. R. Schwedes, Lawrence Laboratory, Santa Monica, Calif., treasurer.

New directors are W. A. Dubovick, Engineered Precision Casting Co., Matawan, N. J.; J. H. Cadieux, Casting Engineers Inc., Chicago; P. J. Nilsen, Electronicast Div., Nilsen Mfg. Co., Addison, Ill.; T. N. Thys, Precision Founders Inc., San Leandro, Calif., and Mr. Miller. H. P. Dolan, continues as executive director.

Mr. Morison presented the ICI's Whale award to Mr. Carr and Robert H. Herrmann, FOUNDRY, in recognition of their work in preparing the institute's new book, *How to Design and Buy Investment Castings*. The award trophy is an investment-cast, stainless steel whale, signifying a whale of a job, which is mounted on a wooden block. It it given for distinguished service to the institute and the investment casting industry.

First speaker at the technical session was Paul Gouwens, Armour Research Foundation, Illinois Institute of Technology, Chicago, who discussed **New Technology—Will it Affect Investment Casting?** Experimental and production work in four areas of development were covered:

1. Press forgings of castings. This technique combines the advantages of the casting and forging processes. Properties may be achieved in the part above those obtainable by heat treatment alone.

2. Precision casting of dies. Die-casting and forging dies are large parts and experiments indicate that they can be cast best in molds of graphite bonded by bentonite and with the use of exothermic risers. The molds are stable dimensionally and produce castings with 150 microinch rms finish.

3. Grain refinement in metals. As investment castings become larger, grain refinement will be a problem. Solutions lie in the use of inoculation agents and by vibration, mechanical or magnetic stirring, shock treatment, or heat fluctuation during solidification.

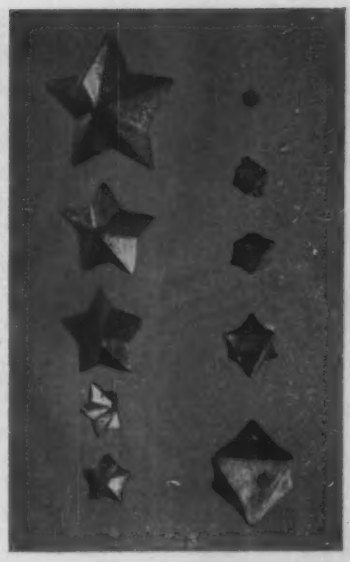
4. Mold-metal reactions in producing high-chromium alloy castings. Experiments are being conducted on mold washes to solve this problem.

The Ceramic Shell—Its development and Effect on the Investment Casting Industry, by T. E. Millard, General Electric Co., Cincinnati. Developments in the shell investment molding process to date, mold and pattern materials, and production techniques and problems were discussed. The process has good potentiality for production of large, intricate castings of 4 ft or possibly 10 ft maximum dimension, irregularly-shaped parts which cannot be made in flask molds, and very thin-sectioned castings.

The making and pouring of shell investment molds also may be automated readily to achieve uniform, high-quality parts.

In a panel discussion of the ceramic shell investment process, Mr. Dubovick foresaw use of the process by most investment casting foundries, with many of them using mechanized production. K. H. Pierce, Precision Castparts Corp., Portland, Oreg., pointed to the chilling power of shells and its effect on casting grain size. He cited a need for pattern and mold materials with identical shrinkage factors to permit use of common pattern tooling for shell and flask molds.

F. D. Lordi and Dr. Keverian, General Electric Co., believe the



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Red Light	Off	Off	On	On
Green Light	On	On	Off	Off
Valve	Energized	Energized	De-Energized	De-Energized
Plow	Down	Down	Up	Up

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shell process can reduce cost of investment castings. They see a need for development of a heat-disposable pattern material better suited for the making of larger parts in ceramic shell investment molds.

Some Observations on Russian Investment Casting Techniques, by N. J. Grant, Massachusetts Institute of Technology, Cambridge, Mass. Mold, pattern, and die materials used in Russia were described and compared with those used in the United States. Production techniques also were compared. Most castings are produced in variations of the ceramic shell investment process used in this country. Investment castings in the 100-lb range and with longest dimension of 30 in. are in regular production. Most of the patterns used are of wax, although some plastic is used.

What We Can Learn from European Investment Casting Techniques, by Mr. Schwedes. Steel castings comprise the biggest volume of investment foundry output. Generally, 12 to 30 pregated patterns are made in a single die. This facilitates subsequent treeing operations and aids achievement of high productivity by workers. Some castings are produced in ceramic shell investment molds and are thicker than those used in this country. They consist of about 18 dip and stucco layers in Germany and about 9 layers in England.

Where Are the Investment Casting Buyers? by D. W. Veit, *Precision Metal Molding,* Cleveland. This first report of a continuing study on the market potentiality for investment castings indicates that a wide variety of fabricating industries are interested in investment castings. Continuing study is expected to segregate industries having greater and lesser interest and thus aid investment foundries in their marketing plans.

A Basic Cost Estimating System for Smaller Plants, by Freeman Jones, Misco Precision Casting Co., Whitehall, Mich. Mr. Jones, chairman of the ICI Cost Study Committee, presented the committee's manual on basic cost accounting and estimating for investment casting foundries, particularly those employing less than 75. Studies show a need for this type manual by foundries in that employment range.

If foundries price castings incorrectly they will go out of business or customers will be discouraged by wide price spreads in quotations and the market for investment castings will be reduced.

Practical Tips on an Effective Quoting System for the Average Job Shop, by Mr. Dubovick. To quote effectively on casting jobs, foundry estimators must know costs, understand gating and risering, know the technical limitations of his company, and know how to estimate. He also must be familiar with his customer's requirements, standards, inspection procedures, and the customer's knowledge of the possibilities of investment castings.

Also an estimator can be effective only if his foundry management keps him informed on the accuracy of his quotations.

Sees Record 1960 Sales Of Investment Castings

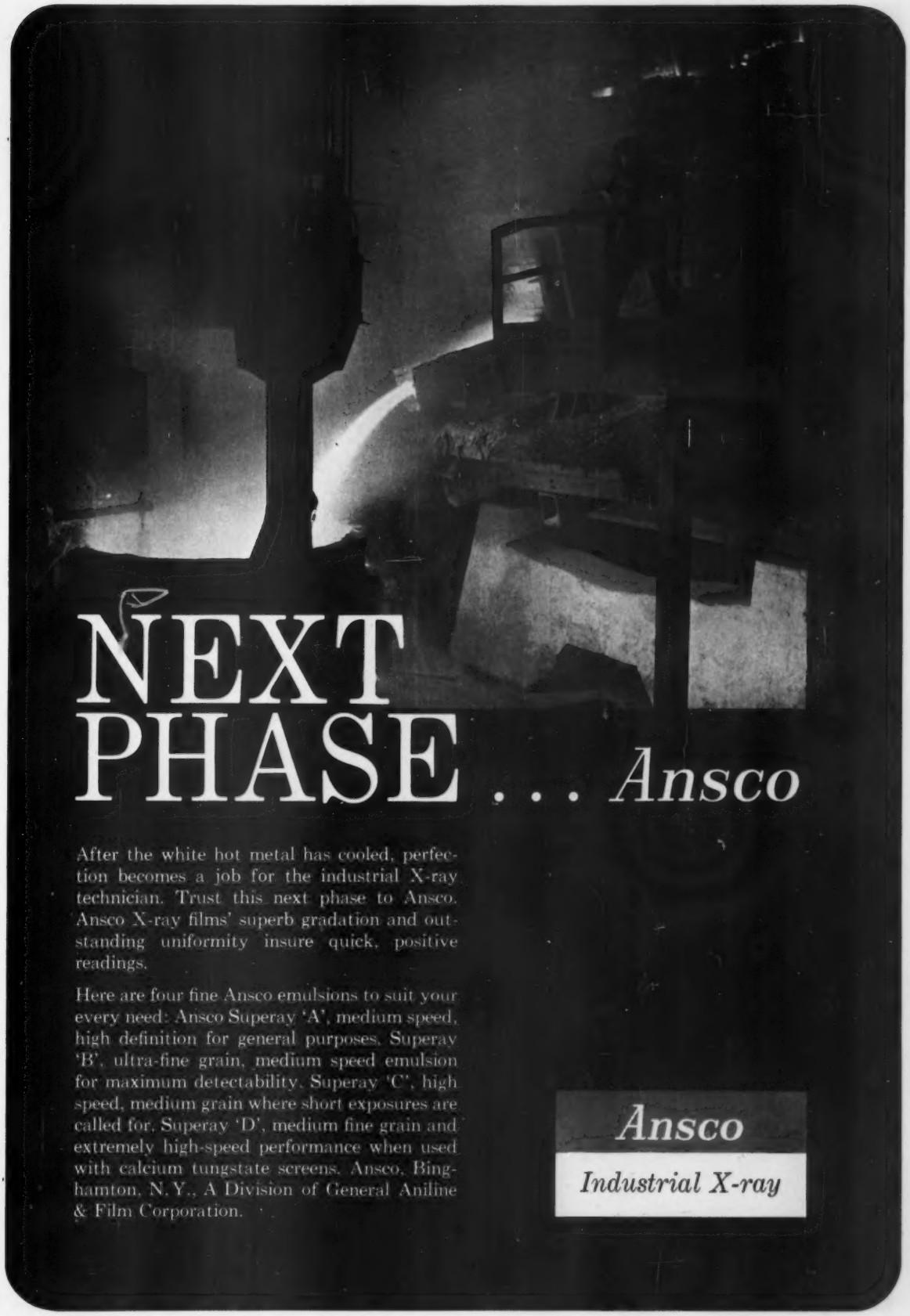
Sales of investment castings to nondefense industries are expected to reach a record high of more than $17 million in 1960. This prediction was made by Joseph H. Cadieux, president, Casting Engineers, Chicago.

He pointed out that the trend of producing investment castings almost entirely for defense industries has changed. Manufacturers of electronic equipment, machinery, firearms, and products for consumer end use are accounting for a large demand for investment castings. The latter castings are smaller than those for defense and sell at particularly low prices.

Accident Prevention Manual Published by Safety Council

The fourth edition of the "Accident Prevention Manual for Industrial Operations" has been published by the National Safety Council. The volume was compiled, edited, and reviewed by safety specialists. It contains more than 50 illustrations and 1542 pages of data and includes knowledge of safety men from nearly 7000 U. S. industrial firms.

More information about the manual can be obtained from the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.



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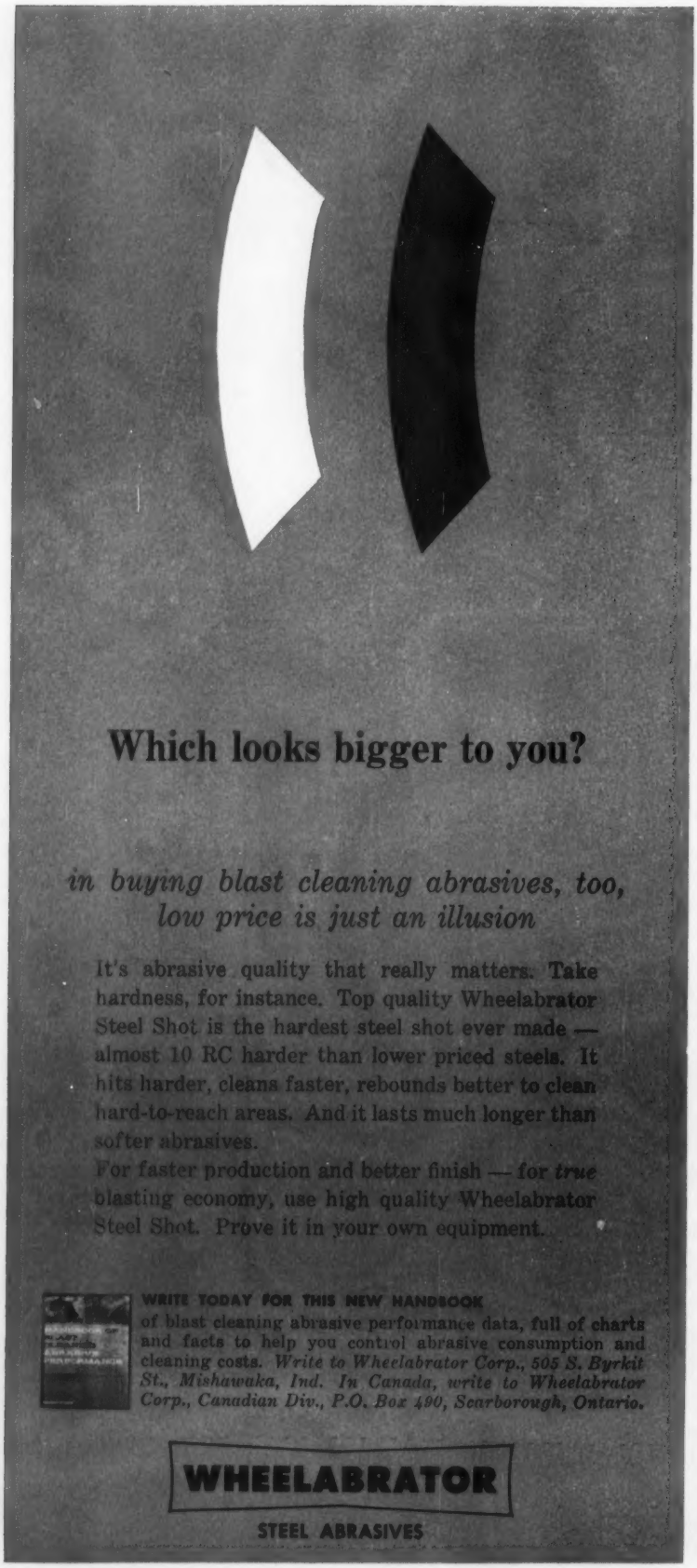
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in buying blast cleaning abrasives, too, low price is just an illusion
It's abrasive quality that really matters. Take hardness, for instance. Top quality Wheelabrator Steel Shot is the hardest steel shot ever made — almost 10 RC harder than lower priced steels. It hits harder, cleans faster, rebounds better to clean hard-to-reach areas. And it lasts much longer than softer abrasives.
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Book Review

How to Design and Buy Investment Castings, **cloth, 176 pages, 6 x 9 in., published by Investment Casting Institute, Chicago. Price $3.95.**

The investment casting process is described clearly and authoritatively with specific attention to areas of value to those utilizing metal parts in their products. Over 80 illustrations show cost-saving uses of investment-cast parts and emphasize process and design techniques discussed in the text.

Latest techniques of producing investment-cast parts in flask-type molds and the newer ceramic shell investment molds are described and illustrated. Up-to-date developments are presented on vacuum technology for producing alloys and cast parts.

The importance of correct casting design is emphasized throughout the book but is discussed in detail in a comprehensive chapter on that subject. Specific data are given for various cast part configurations.

Detailed ICI specification are presented for several casting alloys. In addition, a selection chart lists compositions over 115 ferrous and nonferrous alloys plus ICI, AMS, SAE, ASTM, federal, and military specifications. General casting specifications are discussed. A separate table on ten vacuum-prepared alloys lists compositions and typical applications.

Radiographic and surface inspection procedures are discussed in detail and ICI standards for radiographic and surface quality are stated. Tables list casting quality requirements for specific quality levels. A separate section covers airfoil standards.

Suggestions are given to buyers on preparing and submitting requests for quotations on cast parts, how to get the best price on quantity orders, what to do about pattern tooling, a practical understanding of delivery schedules, and on the value of sample castings. Other sections cover castings specifications, data to be included on blueprints, and a suggested buyers' inspection procedure.

The book also explains the purposes and functions of the ICI and provides definitions of terminology used in the investment casting industry.

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Heavy Duty Hicycle Angle Grinder with rotating wheel guard.

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New with these models is the CP *"Tri-Flo" Cooling* System that minimizes "hot spots". This highly efficient system cools motor windings, rotor shaft, main bearings, gear case and switch. Keeps the temperature rise at key points as much as 28° lower than with conventional type cooling.

You get these 7 extra advantages with CP Hicycle Grinders

1—*Hicycle Motor* of advanced squirrel-cage design means no brushes to replace, no armature to burn out. 2—*Power/Weight Ratio* is outstanding because high strength magnesium castings are used for motor, gear case and switch handle. 3—*Oil Sealed Ball Bearings* lubricated for life. 4—*Interchangeable* motors, motor housings, switch handles and switches on all straight and angle models. 5—*Heavy-duty switches* have dust tight seals and phenolic spacers for insulation from motor and to minimize vibration. 6—*Extra heavy micro-mesh gearing* heat-treated for long service. 7—*Guards* fully conforming to A. S. A. safety codes.

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Circle 621 on Page 53

Man to Man

By RALPH L. LEE, *President*

Lee Hobby Foundry
Birmingham, Mich.

"We can do a whale of a lot of good for ourselves and our clients by doing some showing off and sharing our bag of foundry tricks"

Clients vs. Customers in the Foundry

● LEE HOBBY FOUNDRY had a rather distinguished client a short time ago. I'm using the title "client" instead of "customer" because this fine fellow wanted something besides castings. He wanted to get into the pattern subject with us, but he thought it best to talk over some of the engineering angles of his project before he did so. He felt that all three phases of it were pretty well tangled up together.

Our client had retired recently as chief engineer from an internationally known and respected organization engaged in the development and manufacture of just about the most complicated mechanical and electrical apparatus mankind has been able to concoct.

With the problem-facing-and-solving momentum he had gathered over his many years, he said that it was just impossible for him to do nothing. So he plunged deeply into astronomy, a hobby he'd been splashing around in for years. One telescope led to another and the last one he bought is surely a beaut. Boy, what a hunk of stuff! He also built a sidereal clock in his basement shop; made all the gears himself. I never knew there was such a thing, but we'd better not get into that subject.

The third sundial he's about to build involves some rather tricky castings, and through mutual friends he came our way. Now, I'll not deny that I'm bragging a bit about the company we keep, but that isn't the real reason for this little essay or whatever you want to call it. The real reason is the keen interest he showed in all of the details involved in transforming his original sketches into drawings, patterns, and castings.

Principles vs. Practice—Although patterns and castings always had been a part of his professional life, he never had had the time to chaperon a particular job from its conception, through gestation, to the delivery room (castingwise, that is). He was thoroughly familiar with the need for draft on patterns and

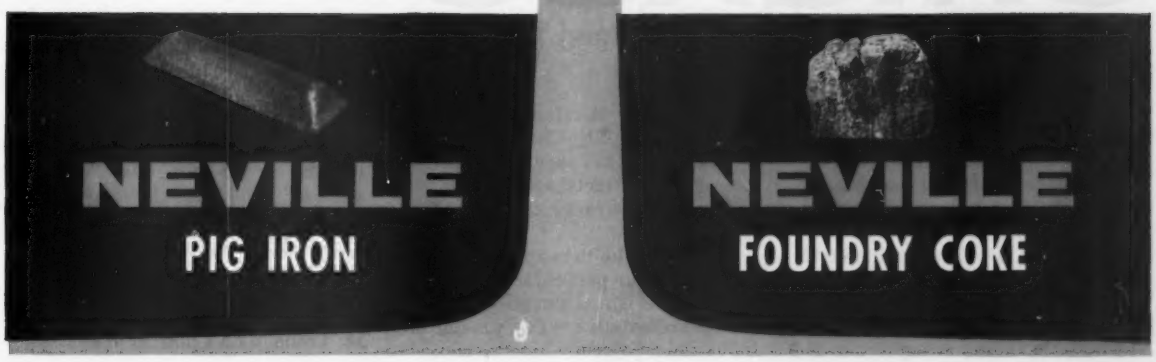
Foundryman shows his tricks

understood the principle involved. But as he whittled out his own patterns, he found that applying these principles was a whole lot more exacting and tricky than the simplicity of the principles indicated. This realization came to him as he watched a cope being lifted and his pattern being drawn.

Having had previous experience with do-it yourself patternmakers I suggested that he come to see us before he filleted and varnished his patterns. He was like a kid with a new toy when he saw the kinds of fillets available, the tools and methods of applying them, and realized the skills required. Again, as he watched the molding operation, the vital importance of fillets and varnish came into a sharp focus. (I wonder where these homemade patternmakers get the tacky gunk they lay on their master pieces with trowels?)

I was tickled that this fine fellow found the casting procedure interesting enough for him to stay with it from beginning to end. The significance of sand conditioning became quite real to him—the skills required, the odd tools and equipment, and judgment. I'm sure he got a much clearer conception of the difficulties which can be avoided easily if the demands of the castings process are taken into account, even

Quality Products for the Foundry Trade



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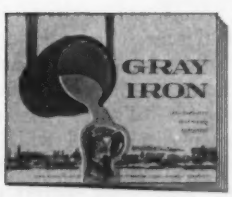

An illustrated brochure on the Gray Iron Industry and its place in the nation's industrial economy. Includes descriptive data on casting practices and the story of the production of Neville Pig Iron and Neville Foundry Coke.

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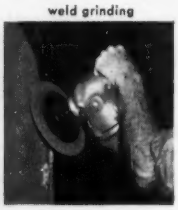

in the sketching stage of the original design.

My friend (by this time) stood by—in fact, he helped—while we estimated the melt, melted the metal, poured off, degated, snagged (nothing to speak of, few fins, smooth as cast, all good—that is, practically speaking).

Invite Them In—As he took his castings home, I couldn't help thinking, "Wouldn't it be a fine thing if we could inveigle, cajole, or persuade the people responsible for casting design to knock off from their heavy schedules and see the casting drama from the rise of the opening curtain to the close of the last act, with their own creation starting the performance?"

Sometimes I'm afraid that we underrate the possible interest our noble old craft can have to those outside the fraternity. Really, when you get right down to it, it's beyond the comprehension of the vast majority—even those who depend upon it. Most industrial folks can get the hang of most other manufacturing processes with little difficulty, but they hardly know where to take hold of founding. At least, that's the way it seems to me from my personal experience with visitors in our little foundry.

Maybe I'm making a mountain out of a molehill, but I still say we can do one whale of a lot of good for ourselves and our clients by cracking the ice for a bit of showing off and sharing the bag of foundry tricks we have up our sleeves. And, by the way, from now on Lee Hobby Foundry is going to deal exclusively with clients instead of customers.

St. Louis AFS Chapter Pays Honor to Former Officers

To honor four former officers who died in 1958 the St. Louis Chapter of the AFS recently presented a set of AFS technical volumes to O'Fallon Technical High School, the city's newest vocational school. Presentation of the technical volumes was made by the officers of St. Louis chapter. The chapter feels that interest in activities of the school will be instrumental in attracting young men who will make their careers in the foundry industry.

INDUSTRIAL ENGINEERING APPLICATIONS

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Process Design Statistical Quality Control Equipment Selection	PRODUCING GOOD CASTINGS
Production Planning and Control Predetermined Standard Times Preventive Maintenance	MEETING DELIVERY DATES
Methods Analysis and Improvement Motion Studies Plant Layout and Material Handling Equipment Replacement Analysis	MAKING A PROFIT
Job Evaluation Merit Rating Time Study Incentive Payment Plans	EQUITABLE BASIS FOR REWARDING WORKERS
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Furnace Power Cost Cut

by Control Through Television

Atlantic Foundry Co. cuts electricity costs and increases production by use of a television unit to control demand on its electric melting furnaces. Here's the explanation

By LEO DIRRIG
Chief Metallurgist

and

JAMES ROBERTSON
Melting Superintendent

Atlantic Foundry Co., Akron

and

R. A. ASCHENBRENER
Consulting Electrical Engineer
Triple Insulaire Co., Milwaukee

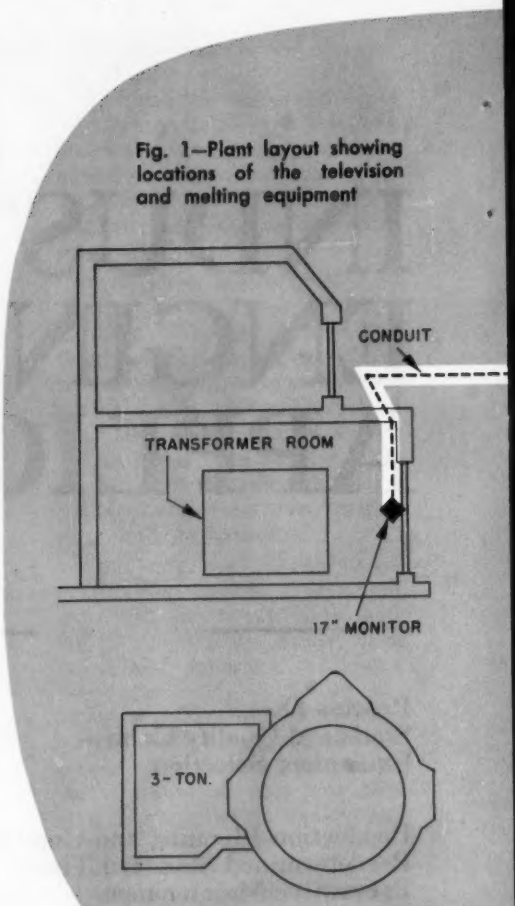

Fig. 1—Plant layout showing locations of the television and melting equipment

● THE HIGH COSTS of labor and materials require that foundries reduce costs and increase production to show a profit in our competitive economy. Atlantic Foundry Co., Akron, Ohio, combined imagination and modern technology to realize savings on electricity and increase production with the use of a television unit to control demand on its electric melting furnaces.

Most of the plant power is distributed at 480 v from a 1500-kva bank of transformers. A small part of the power is supplied by a 600-kva bank of 240-v transformers and the lighting load by a 250-kva transformer at 120/240 v. Transformer capacity for power and lighting totals 2350 kva with a peak load of approximately 1500 kva.

Melting equipment consists of one 3-ton, top-charging furnace with 3125-kva transformer and one 1½-ton, chute-charging furnace with 2500-kva transformer. Combined transformer capacity of 5625 kva permits a fast melting rate, and 50 tons can be melted easily in an 8-hour shift.

Billing Analysis—A detailed analysis of the billing demand for a 15-month period prior to installation of the television control system was prepared. This analysis showed an average monthly demand of 5770 kva, with a minimum of 5480 kva and a maximum of 6100 kva. The goal was to reduce this demand cost to a minimum, yet to keep production at a maximum rate.

Power service is supplied at 24,000 v on an unregulated feeder which is subjected to voltage variations of plus or minus 5 per cent. The recorder demand is based on the average rate of use of electrical energy measured in kilovolt-amperes during any 30-minute period, and the billing demand for each month is the average of the two highest 30-minute demands.

The power company demand meter consists of a Westinghouse Type R1-2 recording kilowatt and kilovolt-ampere demand meter. This meter is situated in a special meter room approximately 150 ft from the electric furnaces, where it is not readily accessible to the furnace operators.

Demand Limiting Systems—Various types of demand limiting sys-

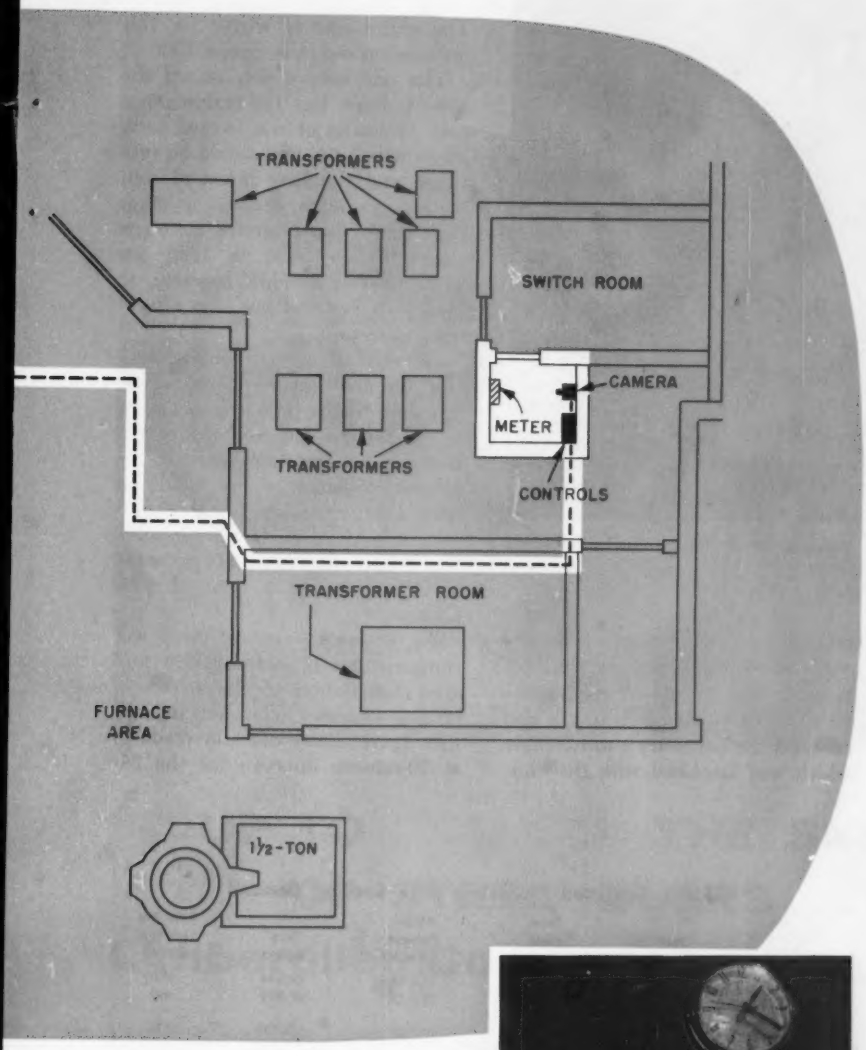

Fig. 2—Power meter chart appearance on the 17-in. viewing screen, which enlarges the chart so that it can be seen easily from the furnace bay

tems were considered. All of them required a duplication of the power company's metering equipment which would have been extremely expensive. These systems will hold the demand to a preselected value fairly accurately by shutting off the furnaces when the demand has been reached. This method saves power, but it may reduce production and thus increase labor costs.

The television method provides an enlarged picture of the actual power company meter chart where it is always visible to the melter. This arrangement permits him to hold the demand to a preselected value. It also permits him to speed up heats when necessary by filling in the valleys of the chart. In this way production actually can be increased with a reduction in peak billing demand. The melter retains complete control of the furnace operation and can produce maximum tonnage with a minimum peak demand.

Fig. 1 shows the locations of the various components of the system in relation to the melting furnaces. The viewing screen or receiver is well sheltered from the heat of the furnaces and is not subject to flying sparks. The 17-in. screen enlarges the meter chart so that it can be seen easily from the furnace bay.

Fig. 2 is a photograph of this unit, which is located inside the transformer room, where it is kept fairly clean and is visible through a glass window. The large electric clock is synchronized with the power company meter chart so that the melter can see easily how much time is available before the meter completes its time interval. The enlarged position of the meter pen also tells him how much of the allocated demand he has used, and he can increase his power load accordingly.

Fig. 3 is a view of the meter room showing the power company meter, the camera, and the control equipment. Proper selection of camera, lens, and lighting unit permits a great deal of flexibility in the location and arrangement of these units. At Atlantic, the distance from the camera to the viewing screen is less than 150 ft, but the proper selection of equipment permits distances in excess of 2000 ft.

Selecting Equipment—Five different types of units were investigated carefully before a final decision was made. Simplicity of design was felt to be most important so that the maintenance department could keep the unit in operation. It also was desired that the unit be rugged enough to withstand voltage disturbances resulting from heavy power surges of furnace operation. A reasonably clear picture image was wanted, but it was felt that the perfection of good home television units was not necessary. The primary concern was to get a unit which could be serviced by a good television technician with readily available parts.

Equipment prices ranged from a high of approximately $5000 to a low of $1840. Analysis indicated that the more expensive units provided a better, clearer picture image, but also were more complicated

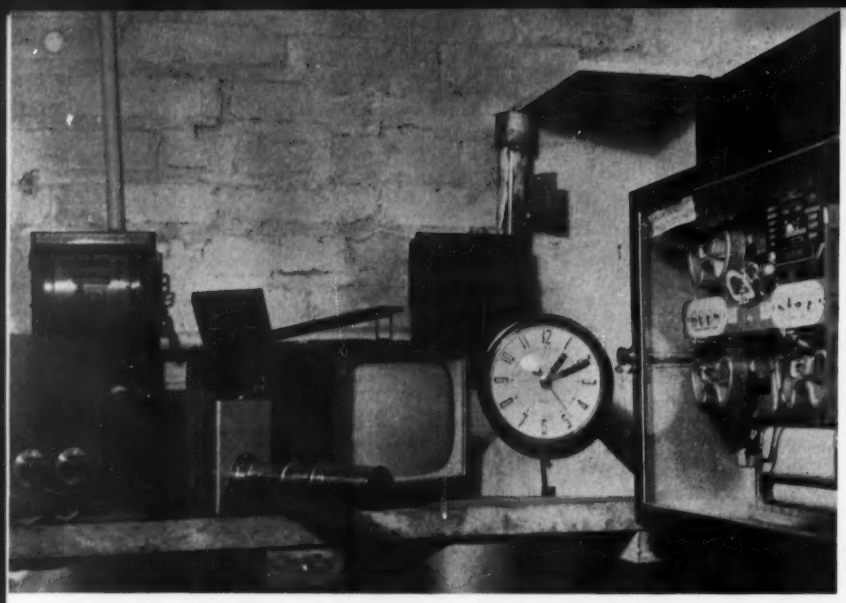

Fig. 3—The power company meter, the camera, and the control equipment

and would be more difficult and expensive to maintain and service. As a result, the lowest priced unit was selected. The price of $1840 included installation supervision.

Installation—All of the installation work was done by the foundry's maintenance and electrical departments. The shelf in the meter room for mounting the camera and control equipment and the bracket in the transformer room for mounting the receiver were furnished and installed by the maintenance department. A 1-in. conduit from the meter room to the receiver, a distance of less than 150 ft, was installed by the foundry electrician.

This conduit contains the 120-v service wires for a two-way switching system which permits the unit to be turned on and off in the meter room or at the receiver. It also contains the necessary control cable which was furnished with the unit. The entire cost of wiring for this installation did not exceed $300.

The one item which caused the most concern was the maintenance cost. Because of the rugged service to which the unit would be subjected and the long hours of continuous operation, the various manufacturers offered service contracts ranging from $620 to $780 per year. It was decided, however, to take a chance and not sign a service contract.

As a result, actual maintenance cost for the last 15 months was less than $125. The original tubes in the camera and receiver are still in use. No accurate record of the number of hours of operation has been kept, but a reasonable estimate would be 80 hours per week for 50 weeks and 40 hours per week for 12 weeks, or a total of 4480 hours.

Fig. 4 shows a copy of the power company meter chart before and after installation of the television control system. The left half of this figure shows demand readings at 30-minute intervals for the 24-

TABLE I—Increased Production With Reduced Demand

Date	Peak Kva	Total Plant Kva	Actual Furnace Time	Tons Melted	Total Kva per Ton Melted
1/29/57	5920	56,316	15.0 RI	82,244	680
3/29/57	4840	58,663	15.0 RS	87,998	665
Difference	−1080	+2,347		+5,754	−15
Difference	−18.2%	+4.2%		+7.0%	−2.2%

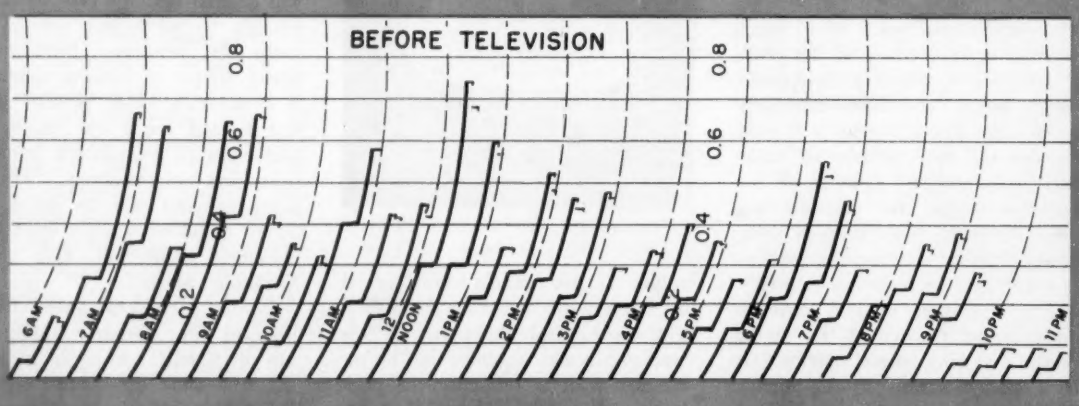

Fig. 4—Power company meter chart before (above) and after (right) installation

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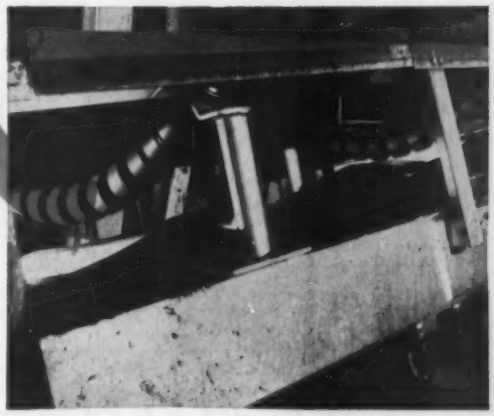
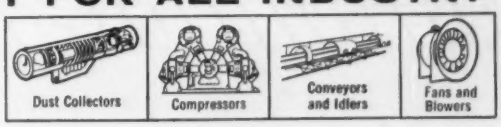
Join the foundry management men who have ended their sand conveyor problems by replacing steel idlers with Joy Limberollers. We'll be glad to give you all the details. Write for Bulletin 347-13.



EQUIPMENT FOR ALL INDUSTRY



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Circle 625 on Page 53

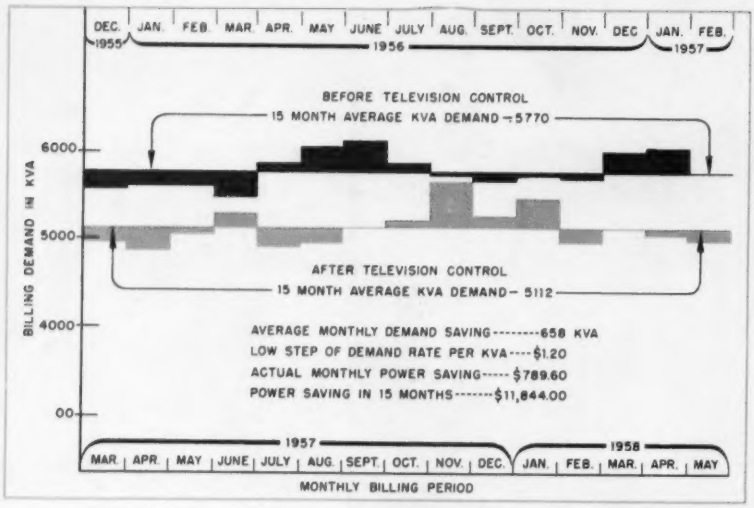

Fig. 5—Actual demand savings in a 15-month period after the installation

hour period on Jan. 29, 1957. This chart shows a peak load of 0.74 x 8000, or 5920 kva, which was used for billing purposes. The irregular nature of this chart is indicated by the fact that three demand intervals were above 0.60 and 15 intervals below 0.40. The actual melting time on this day was from 6:30 a.m. to 9:30 p.m., a total of 15 hours.

The right half of Fig. 4 shows demand readings at 30-minute intervals for the 24-hour period on March 29, 1957. This chart shows a peak load of 0.605 x 8000, or 4840 kva, used for billing purposes after installation of the television control system. This chart shows no demand intervals above 0.605 and only nine intervals below 0.40. The actual melting time on this day was from 7:00 a.m. to 10:00 p.m., a total of 15 hours. These two charts show clearly that the peak demand has been reduced and that the valleys in the power chart are being filled.

Fig. 5 shows the actual demand savings for a 15-month period after installation of the television control system. The black areas at the top of the figure show the monthly billing demand for a 15-month period prior to installation of the television control system, with an average monthly demand of 5770 kva. The colored areas show the monthly billing demand of 5112 kva for a 15-month period after the installation was completed. The average monthly demand saving was 658 kva. This reduction results in a monthly monetary saving of $789.60 based on the low step of the demand rate, which is $1.20 per kilovolt-ampere. The total saving for the 15-month period was $11,844.

The flexibility of this system also is shown by Fig. 5. Note that the billing demand for November, 1957, is unusually high. This high demand was created deliberately. A two-week plant shutdown caused by a strike delayed production, and the higher demand was created by attempts to make up some of the lost tonnage.

A detailed analysis of Fig. 4 shows that plant production actually was increased with a reduction in the billing demand (see Table I).

The power usage for this day shows a reduction of 18.2 per cent in peak demand. The production records show the same furnace time of 15 hours with an actual increase of 7.0 per cent in tons of metal melted and a reduction of 2.2 per cent in total plant kilovolt-amperes per ton melted. This analysis indicates that the television control system results in increased production with a very material decrease in demand cost.

Editor's Note: This paper was presented at the 13th annual Technical and Operating Conference of the Steel Founders' Society of America in Cleveland.

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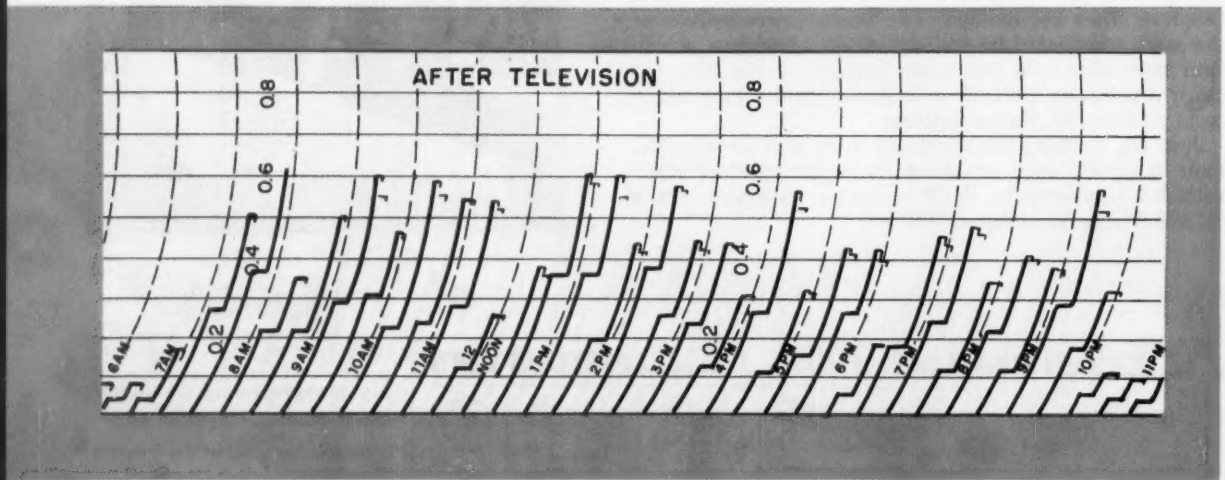

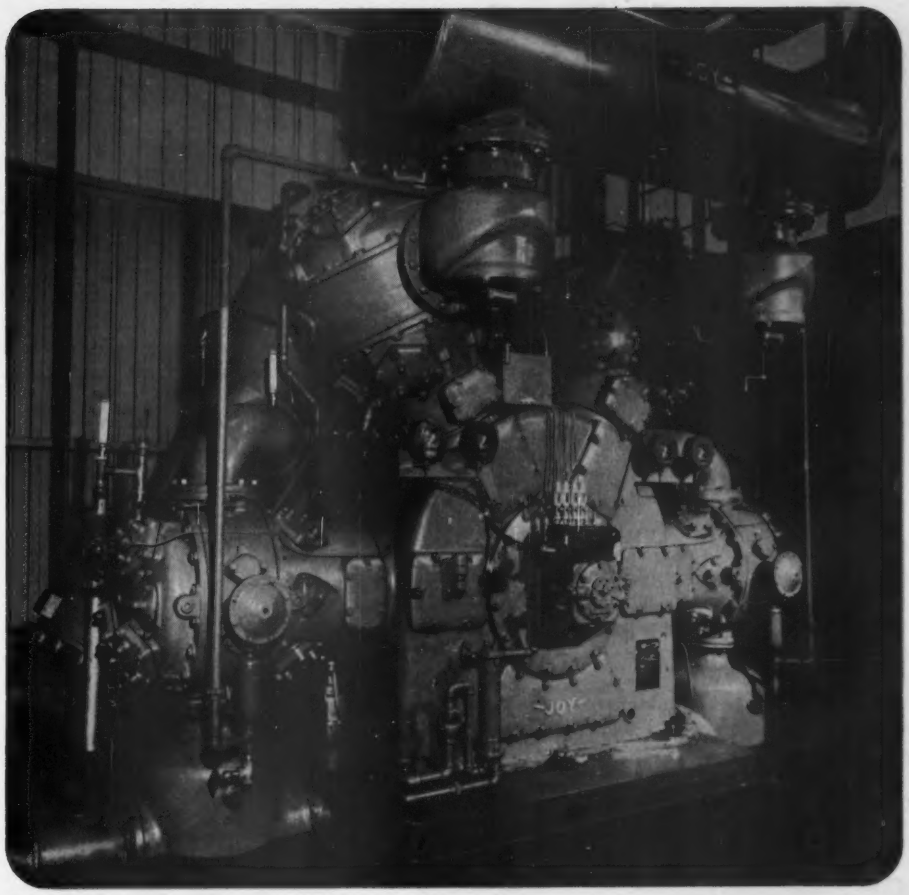

This WN-224 Compressor supplies plant air to a modern foundry in Indiana.

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Around the Country

NEWS REPORTS FROM

Boston . . . Philadelphia . . . Pittsburgh . . . Detroit . . . Chicago

Boston— Gradual improvement in gray and malleable iron melt early in first quarter is likely, assuming there is no resumption of the steel strike. The strike's impact on foundries through the closing weeks of 1959 brought a decline in over-all operations and backlogs. Some shops dropped from five to four-day week schedules.

A brighter aspect is supplied by the textile machinery builders and the return to production by Grinnell Corp., Cranston, R. I., after labor trouble.

Orders for iron castings are somewhat heavier for prompt shipment, but relatively few industries are anticipating requirements. Jobbing shop operations are spotty, with malleable foundries slightly more active than gray iron producers. Textile machinery builders have backlogs for several months in some cases, but this situation does not hold for the foundry industry as a whole.

Moderate increase in price of iron castings is likely this quarter, if competition permits; raw material costs are higher with no decline in labor or transportation foreseen. Shortage in some analyses from the Mystic stockpile will develop this quarter; when this occurs pig iron must come from more distant points. Cast grades of scrap are holding near the 1959 peak.

The nonferrous industry is spotty, averaging about 60-65 per cent capacity. Those supplying the electronics industry and doing fine aluminum work are busy and under pressure for delivery. A few bronze shops are operating 80-85 per cent, but others are slower and bring down the industry average.

Research activities have been increased and some products added at Chapman Valve Co., plant, Indian Orchard, Mass., by Crane Co., which acquired the Chapman company, normally employing near 1400, late last year.

Pittsburgh— Reopening of the steel mills gave foundries a chance to ship a lot of castings that had been piling up in their warehouses, but it didn't stimulate a flood of new orders. Steelmakers are marking time, buying only the bare essentials until they can be sure that production won't be halted by another strike.

Leading steel and gray iron foundries are operating at 45 to 50 per cent of capacity. They're still working 40 hours a week, but in some cases employment is sharply curtailed. Backlogs are negligible. Says one firm: "We've got about a month's production on the books, but in good times we have a three or four month backlog."

Rollmakers are about the only foundrymen who are satisfied with current operations. One company reports that it's running at capacity and has a four-month backlog. Another, working against a two-month backlog, says its customers will continue to buy cautiously until "sometime in January, or whenever a new labor contract is signed." The mills have fairly good roll inventories, but they're asking for rush shipments on some items. During the strike, they had a chance to re-evaluate their needs in the light of rising demand for all their products.

Many foundrymen who were optimistic last June, when sales were running well ahead of the previous year's, had their hopes bashed in

Yugoslav Team Studies U. S. Foundry Methods

A quality castings study team from Yugoslavia visited Engineering Castings Inc., Marshall, Mich., recently as part of an International Cooperation Administration project. The team, composed of foundry and production managers, metallurgists, and technicians, spent five weeks in the United States touring manufacturers of industrial equipment and machine tools, foundries, trade associations, and other, related groups.

David W. Boyd, left, vice president and general manager, Engineering Castings Inc., and Assistant Professor C. C. Sigerfoos, Michigan State University, third from left, are shown guiding part of the team through the foundry. The guests also visited Hamilton Foundry Inc., Hamilton, Ohio.

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> **Magnaflux Magnetic Particle for magnetic metals (Fluorescent with Magnaglo and black light) . . . Zyglo Fluorescent Penetrant for non-magnetics (and some magnetics, too)**

Both offer near-absolute reliability in their recommended uses. Their sensitivity is controllable, and is such that they can safely be used to find any crack that you *need* to find — with you and/or your customer writing the "specs." This in itself can save you much trouble and cost. It avoids over-inspection and under-inspection, both!

Both Systems clearly reveal and mark defects right on the part. Neither require negatives, detailed interpretation or inspection delay. Parts can be inspected at thousands of pieces an hour in fully automated Magnaflux or Zyglo Systems . . . often at tiny fractions of a cent per part. If you want permanent records on some parts, they are easy, by photography or transfer techniques.

Both Systems fit with minimum change into your present production set-up. Use at any stage from receiving, through all processing operations, to final inspection. (Naturally, the earlier the defects are found, the less it costs to find the cause or salvage the parts.)

Many companies have reported hundred-fold savings, over the low initial cost of Magnaflux and Zyglo. Your specific savings can best be estimated by a Magnaflux Engineer. But whatever you make, if you are now taking any reasonable care not to ship or assemble cracked parts, Magnaflux or Zyglo Testing should save you substantial amounts.

And in any case, you'll want the latest data on how these Systems, backed by 30 years of Magnaflux Corporation development, are being continuously made more effective—to meet the needs of new technology in the metal production and fabrication fields. Write for bulletin "Lower Manufacturing Costs" or descriptive booklets on Magnaflux or Zyglo.

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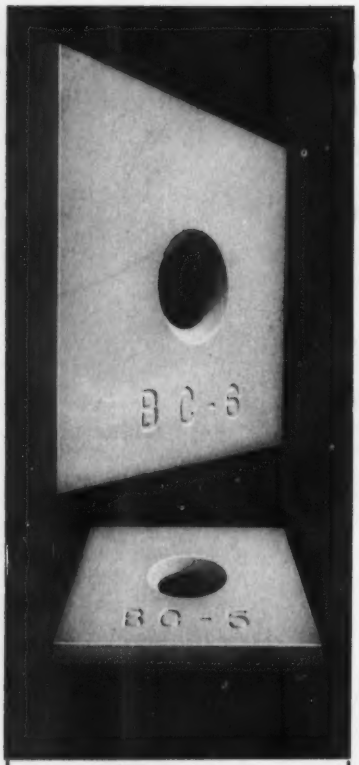

Louthan breaker cores cut foundry costs

You minimize casting problems, get cleaner castings when you use Louthan *refractory* breaker cores. They facilitate rapid removal of the riser, with subsequent labor savings. There is no core gas. Available for all riser diameters from 2″ to 12″, and for use with *any metal casting* risering from a flat surface.

Write for Free Gating and Risering Refractory Folder. Complete file of specifications on all Louthan products.

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Circle 628 on Page 53

the second half. Because of the steel strike, buyers held up their orders and 1959 ended on a sour note. Sales of several foundries were no better than they were in recession-ridden 1958.

Steel and gray iron shops with diversified markets had a relatively good year. The fortunate few included suppliers to the automotive, construction, farm machinery, and heating and plumbing industries, and those that made railroad castings, heavy press castings, and ordnance items. Sales of one major foundry topped the previous year's by 15 per cent. Shipments of a diversified job shop were up 50 per cent.

Barring resumption of the steel strike, foundrymen look for near record sales in 1960. Rollmakers are especially optimistic. Reason: Their sales are closely related to ingot production, which is expected to jump 50 per cent to an all-time high of 130 million tons.

Detroit—Pontiac currently is offering as optional equipment on all automotive models a lightweight, unitary wheel-brake drum which greatly reduces braking fade-out and reportedly increases brake lining life over 50 per cent. The unit incorporates a cast iron liner molecularly bonded to the permanent-molded aluminum wheel-drum by the Al-Fin process.

Pontiac used separate, bonded bimetallic brake drums on its heavy-duty vehicles in 1959 models. Buick had used the same type drum on its cars starting in 1958. The drums for both cars have been made at the Fabricast plant of GM's Central Foundry Div. in Bedford, Ind. The new wheel-drums for the Pontiac are produced by Kelsey-Hayes Co., Detroit. The Cleveland foundry of Aluminum Co. of America is reported to be setting up to cast the wheel-drums also.

A separate, stamped steel rim, which carries the tire, is attached by a scalloped spider to a 9⅞-in. bolt circle on the outside diameter of the wheel-drum. Two views of the assembly are shown here. The point of contact of the iron liner with the wheel-drum can be seen at the finger tips of Clayton B. Leach, Pontiac chassis engineer. The exterior of the assembly, at bottom, shows the eight bolt attachment of rim to wheel. Development of the wheel-drum was a co-operative effort of Pontiac with

engineers of Al-Fin Div., Fairchild Engine & Airplane Corp., West Babylon, L. I., N. Y., and Kelsey-Hayes.

* * *

With the coming of each new model year it seems that more automotive parts are converted to aluminum. Chevrolet made a big jump in that direction with the Corvair engine which contains several major parts of cast aluminum. These, however, do not include a block. Individual cast iron, finned cylinders are used in the Corvair engine.

As generally is true of most major engine changes, difficulties often occur until the bugs are worked out in production. Unfamiliarity with casting techniques employed at Chevy's aluminum casting plant at Massena, N. Y., reportedly is causing high rejection rates on engine parts. Rejects on cylinder heads are said to exceed 30 per cent. Also it is said that production rates are slow on the crankcases which are permanent molded in low pressure machines. One source says that production could be increased if standard gravity pouring methods were employed.

Possibly Chrysler will be the first large auto firm to get into production on a cast aluminum block engine. About 200 diecast engine blocks have been produced for testing purposes. The company has at least one diecasting machine at its Kokomo, Ind., casting plant capable of producing engine blocks. In the

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Hartley Sand Controller, Series XII, operates all — or any combination of:

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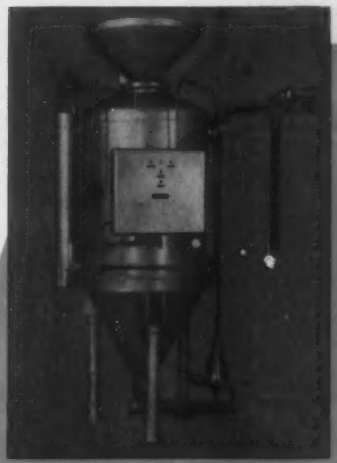
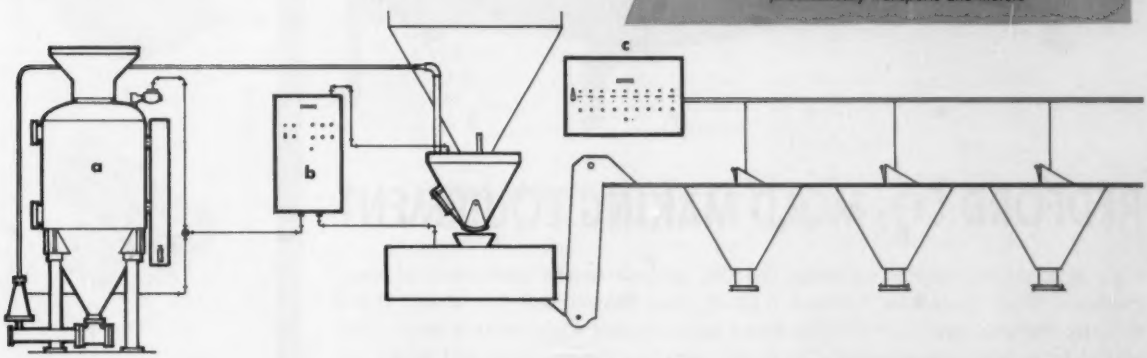
A single Hartley control cabinet *delivers* the precision impulses that remove guesswork, loss of time and lack of uniformity in foundry sand systems. From transporting raw sand to the control of moisture, bond additions and cycling in the sand reconditioning process, there is no waiting, no waste, no wondering. What's more, it is not necessary to automate your complete operation at once. Hartley equipment can be added and interlocked in stages. Let the savings from one unit pay for another until your sand system is fully automated.



Hartley Bond Feeder — *pneumatically transports and meters*



Line drawing shows a typical Hartley installation:

(a) Bond Feeder, (b) Series XII Sand Controller, (c) Sand Level Control.

Complete specifications and recommendations concerning special problems will be sent promptly.

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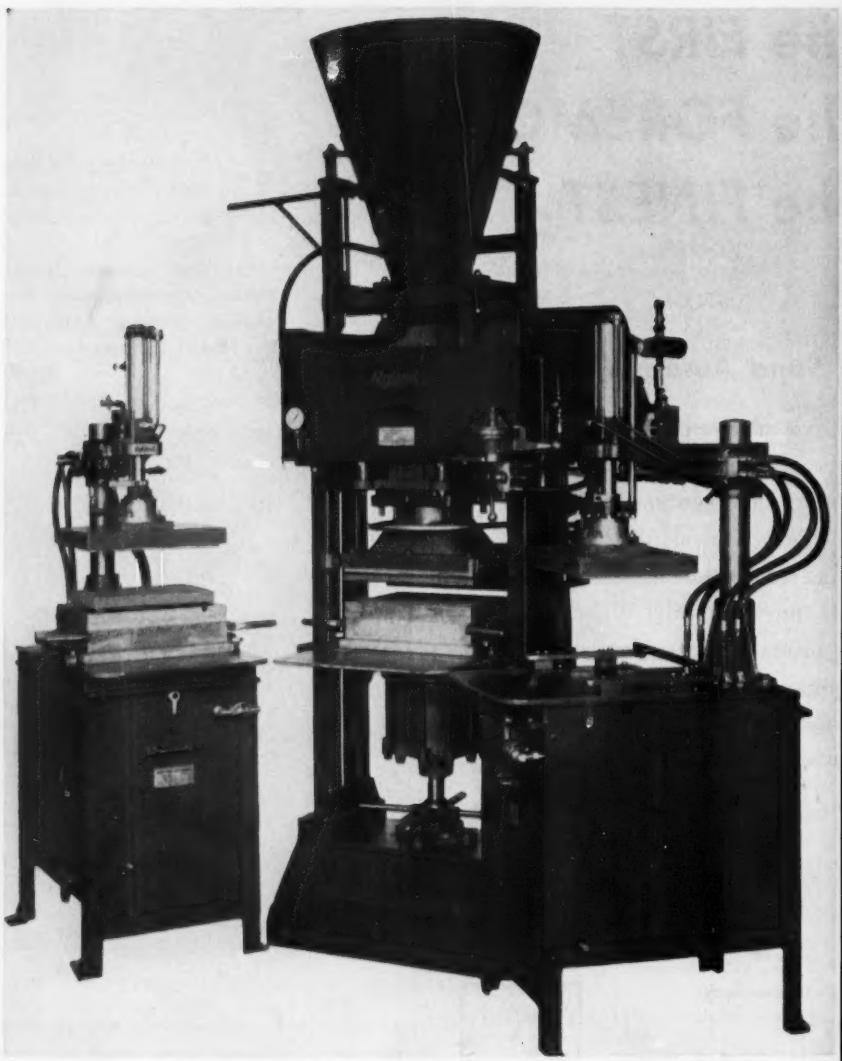

REDFORD CO_2 MOLD MAKING EQUIPMENT

Here is a proven way of applying the CO_2 process to the production of small castings. With the above Redford #420-D Core Blower and (2) Model H-2-M Gassing Stations, one mold is being blown and squeezed while another one is automatically gassed and stripped. Up to 80 complete molds (cope and drag) are produced in one hour. Molds are flat and can be stacked for pouring. Metal yield is greatly increased. Very little floor space is required. Millions of small parts have been cast to close tolerances at reduced costs. For complete information write for BULLETIN No. 421.

TYPICAL CO_2 MOLD CASTINGS

½ Actual Size

Redford IRON & EQUIPMENT CO.
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near future the plant will have four of the 2000-ton capacity machines capable of delivering a shot of about 75 lb of aluminum.

Chrysler engineers feel that the automotive industry has run the gamut on heavy, high displacement engines. New engines must be light in weight and have relatively high output.

Manufacturers outside the automotive industry also continue to work on development of new engines. Curtiss-Wright Corp., working with a West German diecasting firm, Nsu Werke, has developed a light, cheap, efficient internal combustion engine with only two moving parts. The engine combines features of a gas turbine and piston engine, and is expected to go into production during 1960 in models of 100 to 700 hp for use in land, water, or air vehicles and for industrial applications.

Chicago— The castings industry is cheered by the optimistic business prospects which most metalworking industries are expressing for 1960. It appears that foundries will produce and sell more castings this year than they did in 1959.

Unfortunately, one big user of castings—farm equipment manufacture, which is so heavily concentrated in this midwestern area—isn't sharing in the rosy predictions for this year. Fear is growing that farmers will experience shrinking incomes in 1960 as they did in 1959. Federal economists believe farmers in many states will buy less equipment in 1960 and probably will cut back on other purchases that can be postponed.

If this proves to be so, the output of farm machinery may turn down this year and many foundries will be affected.

For about 20 months, sales of farm equipment have been at a strong pace. For calendar year 1959, sales should reach $1.75 billion. This would be more than 15 per cent above the $1.5 billion of 1958 and the best since $1.9 billion in 1951.

Contributing to the good showing of 1959 was the 1958 higher income which provided farmers with the cash to invest in new, more efficient equipment. Profits from farming in 1959 were expected to fall to $11.2 billion, or 15 per cent below 1958. Looked for this year is an income of around $10.3 billion, lowest since 1942. Highest in history was $17.3 billion in 1947.

Tending to retard tractor and implement sales also will be slightly higher prices which manufacturers find they must impose to maintain profit margins.

Production of farm equipment suffered very little from the long steel strike. The industry did a good job in determining its requirements and starting early to acquire the necessary steel inventory.

* * *

Separating its industrial research from manufacturing processes, Fairbanks, Morse & Co. on Nov. 23 opened its new corporate Research and Development Center and Laboratory at Beloit, Wis. At the same time, the company announced its research budget is being upped from $1.5 million in 1959 to $2.5 million for 1960.

The center has accommodations for a research staff of 30 to 50 scientists and engineers, for supporting personnel such as draftsmen and technicians, and for a technical library. Usable space is ample for research and development work in the electrical, electronic, mechanical, and hydraulic fields. In addition, there will be a chemical and metallurgical laboratory and a small, well-equipped shop.

Fairbanks Morse operates foundries in Pomona, Calif.; East Moline, and Freeport, Ill.; Kansas City, Kans.; Johnsbury, Vt.; and Beloit.

Philadelphia— Following a seasonal lag in December, foundry business may continue spotty for the next few weeks and then gain

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strength as spring approaches. Some casting producers anticipate a definite upturn by mid-February.

In gray iron, demand for light and medium work still dominates, including requirements for power transmission equipment, tobacco processing machinery, papermaking machinery, water treating equipment (traps and small valves) and a diversity of other needs. Heavy work is featured by a good demand for auto dies, but little else.

Until recently most gray iron job shops had been operating at 80-90 per cent of normal capacity, but with a decline in orders and the holidays at hand, production has slumped. Two long holiday weekends, with some shops down for an entire week or so, as part of their annual vacation pattern, have cut sharply into production.

Steel foundries likewise have been affected. Previously they had been able to maintain a five-day week operation with full working forces in most cases. Backlogs at around five weeks have not been too good considering the processing involved in production of steel castings, but at least sufficient to provide a fair cushion. Needs for heavy industrial equipment have been somewhat limited.

Barring the present lull, most malleable shops have been operating at five days a week and more in some instances. Those specializing in pipe fittings and hardware have been doing particularly well recently.

Business with the brass shops has been rather spotty for some time. This has been true of the independent foundries and also certain captive shops, such as producers of heavy industrial valves and fittings and ship requirements. About the only work of consequence in this latter field has been coming from the Navy.

Some captives have been doing very well, however, especially those working on meters and plumbing supplies. Indications are that they will soon have to farm out business. In light metals, jobbers and captives generally have been operating at good rates.

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AND
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with the famous
STANDARD
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TURN HAND WHEEL—automatically adjusts guard, increases spindle speed in relation to worn wheel—you get FULL WHEEL WEAR DOWN TO FLANGES! Foundries report as much as 100% increase in wheel life.

INFINITELY VARIABLE SPEED means proper peripheral speed at all stages of wheel wear—AS MUCH AS 60% INCREASED PRODUCTION FROM CONSTANTLY CORRECT WHEEL SPEED AT POINT OF GRINDING!

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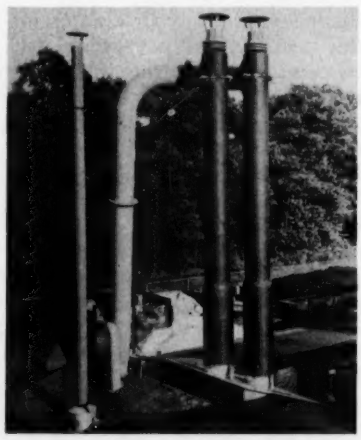

TWO-TUBE HEATER: Front blast heater with capacity of 3000 cfm at 650° F is installed in two No. 6 cupolas at the Plainville Casting Co., Plainville, Conn. Heater has natural gas combustion equipment and is completely electronic flamed safety protected with an automatic temperature recording control. Actual cfm of the unit is 2600 to 2700. The heater is a product of the Brown Thermal Products Co., Elyria, Ohio

OTTAWA SILICA SANDS...

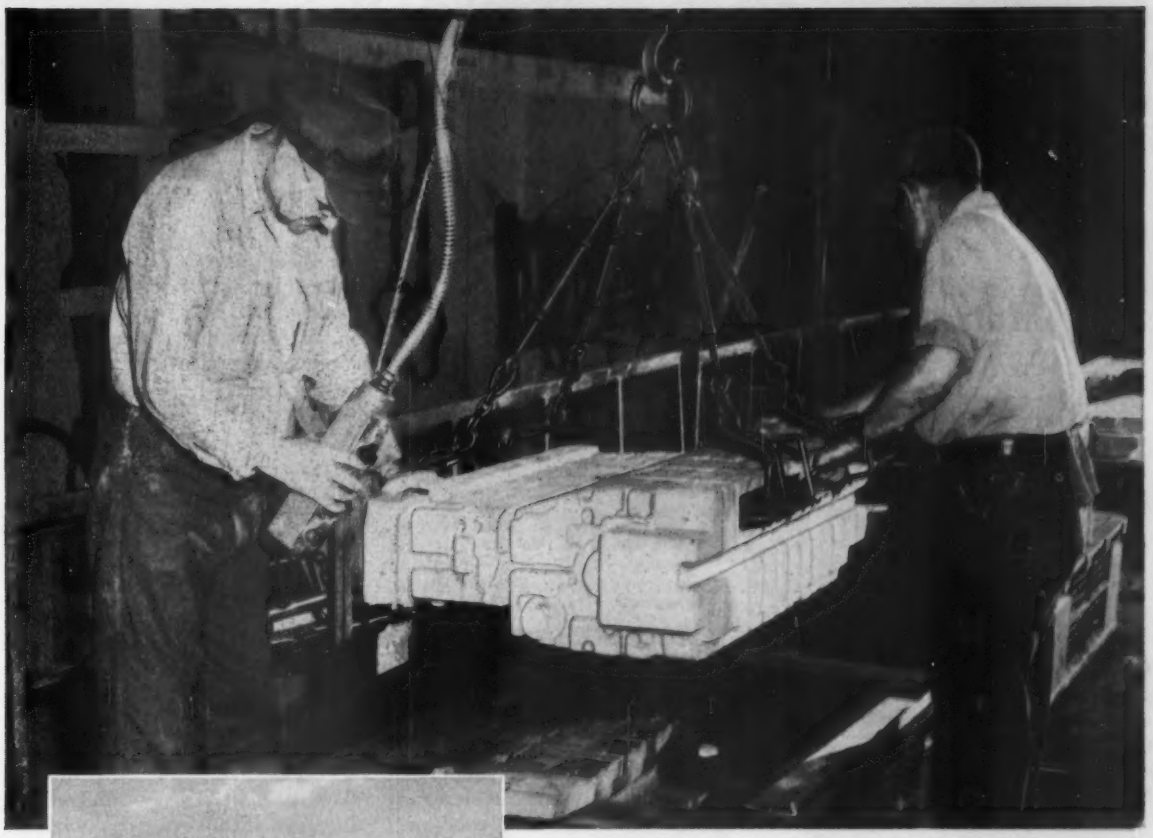

Photo courtesy of Caterpillar Tractor Co.

CORE SETTING STATION AT CATERPILLAR TRACTOR CO.
Cylinder block line, Peoria, Illinois plant.

Caterpillar Tractor Co. has used Ottawa Silica Sand for 30 years for these reasons: Availability — performance — cost. Caterpillar requires large tonnages of core sand and must have a dependable source of supply. Cores produced with Ottawa silica sand are uniform in hardness. Two important cost-saving factors are *low oil requirements and high reclaimability.*

Look to Ottawa Silica for ROUNDNESS OF GRAIN AND FREEDOM FROM AGGLOMERATES . . . GRAIN SIZE CONTROL, car-after-car.

Mail us your type of metal and size of casting section—we will be happy to send recommendations for grain size.

A Caterpillar crawler tractor FJP at work on trans-Canadian Highway, near Field, B.C., Canada (core of engine block produced with Ottawa Silica Sand).

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Serviced by two main trunk railway systems, Ottawa Silica offers fast delivery to all corners of the nation.

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SERVING THE FOUNDRY, GLASS AND CERAMIC INDUSTRIES FOR OVER 50 YEARS

James S. Vanick, conference chairman (left), with E. A. Zeeb, Philadelphia Chapter chairman, and Henry C. Winte, a program chairman

Metropolitan Chapter Host to

EAST COAST CONFERENCE

By WILLIAM G. GUDE
Managing Editor

● AN INTERESTING technical program helped to attract a large attendance at the successful East Coast Regional Foundry Conference held at the Statler-Hilton, New York, Nov. 20-21.

Eighteen papers devoted primarily to gating and risering, mold materials, and melting practice provided considerable practical information to about 250 foundrymen, the largest attendance for an East coast meeting. Metropolitan Chapter of the American Foundrymen's Society was host to the conference in co-operation with the Chesapeake and Philadelphia Chapters. James S. Vanick, International Nickel Co., New York, was conference chairman.

Technical reports follow:

Effect of Soundness on the Mechanical Properties of Cast High-Strength Steel, by Hugo Larson, American Brake Shoe Co. Comparison of x-ray quality and tensile properties of cast high-strength steel was described. In general, tensile properties correlate fairly well with radiographs of thin slices of test specimens. While such specimens from a casting may not give a reliable picture of quality of the part as a structural component, results indicate that the slight traces of microshrinkage have a rather pronounced effect on the ductility of tensile specimens of cast ultra high-strength steel.

Use of Insulators and Exothermic Compounds in Risering Steel Castings, by Harold Bishop, Exomet Inc., Conneaut, Ohio. Use of exothermic materials in eliminating centerline shrinkage and underriser shrinkage was discussed. In the former type, it has been indicat-

Some of the conference speakers and chairmen. Top row, left to right: Harold Bishop, Frank B. Herlihy, Hugo Larson, W. Maher, Victor Rowell, George Di Sylvestro, W. W. Goessel, C. William Gilchrist, Clyde Adams. Bottom row: N .A. Birch, William H. Baer, J. G. House, George Watson, Frank B. Herlihy, E. C. Troy, E. A. Lange, William H. Baer, and John W. Clarke

Photos by John R. Bing, Metropolitan Refractories Corp.

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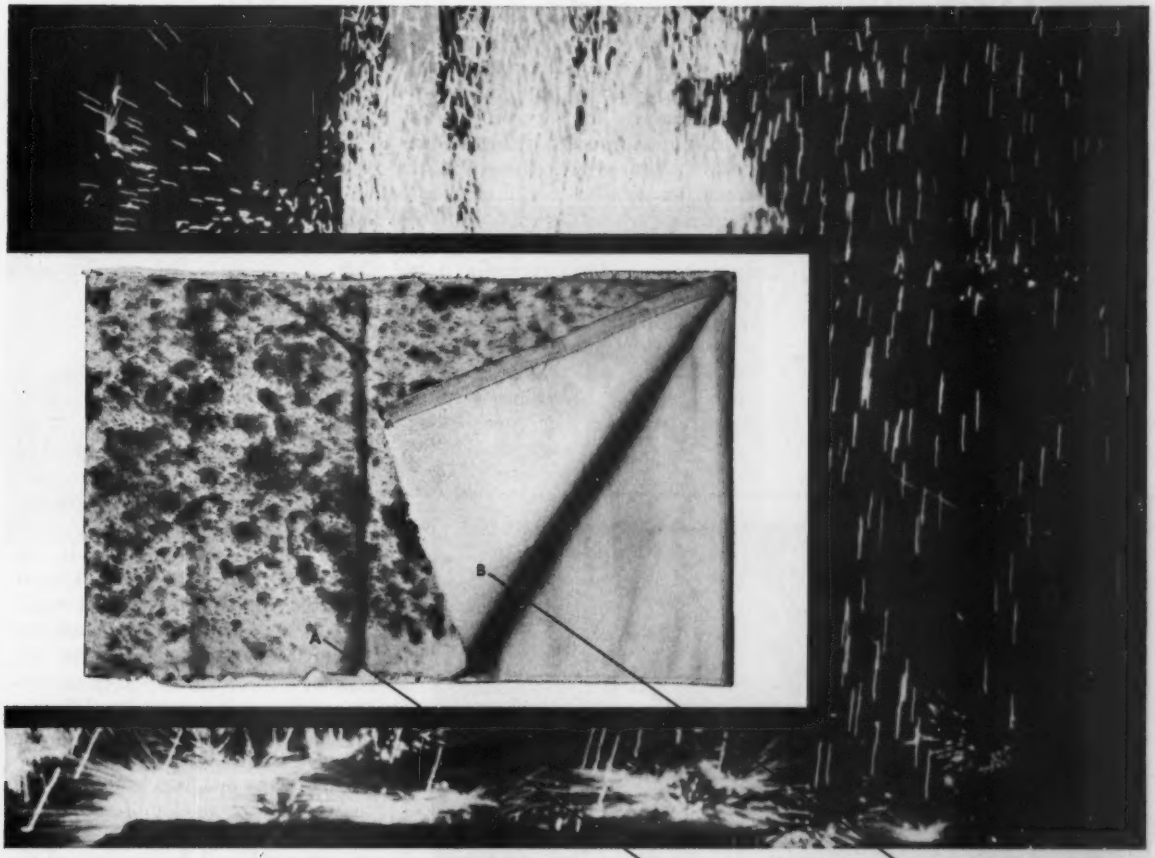
IT'S NEW AO "THERMOGARB" ASBESTOS CLOTHING



A Here's the *outer* side of the material which was directly exposed to the molten splash at a distance of 8 feet from the pour.

B Here's the *inner* or wearer side of AO Thermogarb. After 7 minutes of splash exposure there's no burning through or penetration, no scorching, not even a blemish.

AO Thermogarb is a NEW *lightweight* asbestos cloth. A 30-inch length coat weighs approx. 3¾ lbs. as against conventional asbestos coats of 6½ lbs. — or approximately the same weight as aluminized asbestos coats of the same length. This completely field-tested material is available in a complete line of body protection for high heat — molten splash protection. Your nearest American Optical Safety Products Representative can supply you.

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ed that wherever metal padding has proved successful, it can be replaced with moldable exothermic padding of a thickness equal to 85 per cent of the metal padding.

While small risers tend to lose most of their heat by conduction into the molds, increasing riser diameter causes increased heat losses from the tops of the riser by radiation and convection. Consequently, moldable exothermic sleeves are more effective for small risers in increasing their efficiency than are the highly exothermic metal-producing powders. As riser diameters increase, relative efficiency of the exothermic sleeves decreases, and the efficiency of exothermic powders increases.

Requirements for Steel Molding Sand, by E. C. Troy, Pennsylvania Steel Castings Co. Sand testing has not achieved its desired objectives, and more fundamental research is needed. This lack of progress partly can be attributed to the fact that we don't know what to look for or how to find it. One difficulty is that so many variables exist in foundry practice in addition to those of the sand mixture itself. It is possible, therefore, that the solution to certain problems—hot tears, for instance—may be found in the metal rather than in the sand.

Moldability of Steel Sands, by George Watson, American Brake Shoe Co. Moldability, refractoriness, and collapsibility are important considerations in a steel foundry sand. It would be desirable if some addition could be provided which would remove oxygen from mold materials. Moisture content must be adjusted closely because small changes have a major effect on permeability and strength. The correct proportions of clay and water are requisites in producing the correct workability. A mold hardness tester should be used regularly because of the correlation provided between hardness and desired mold properties.

Carbon Additives in Steel Melting, by Stanley Gilbert, Petrocarb Inc., New York. This paper compared the carbons normally used as a substitute for pig iron in steel melting and for recarburizing molten steel. It also covered the effects of impurities on efficiency of recovery, including the effects of various methods of charging the carbon in the furnace. Also discussed were the methods of recarburizing, including the injection process.

Recent Advances in Steel Melting Practices, by John Zotos, Watertown Arsenal, Watertown, Mass. Recent advances in steelmaking practices at the Arsenal have accomplishd two purposes: 1. Clarified the necessity of minimizing phosphorus and sulphur contents in low-alloy steels to maximize ductility and toughness at low, medium, and high-strength levels. 2. They have shown that the ductility and toughness of these cast steels can be further significantly improved through the use of vacuum melting and casting techniques.

Solidification and Risering of Gray Iron, by Clyde M. Adams, Massachusetts Institute of Technology. Side-wall movement has an important influence on solidification of gray iron castings. A riser for a dry sand casting generally will feed the casting even though the riser may be so small that it solidifies before the casting. This condition exists because virtually all true solidification shrinkage of most gray irons has occurred by the time the casting is 20 per cent solid.

Insulating sleeves and top shields do not act the same with different metals. For instance, insulation is four times more effective with aluminum than with steel and twice as effective as with copper for risers of the same size.

Economical Founding of Ductile Iron, by William Gilchrist, Cooper-Bessemer Corp., Mt. Vernon, Ohio. The savings possible by producing sound castings without risers were described in an article in FOUNDRY, October, 1959.

Gray Iron Molding Sands, by Victor Rowell, Harry W. Dietert Co., Detroit. Natural bonded molding sands have these advantages: Comparatively broad moisture tolerance with good resistance to drying out. Less necessity for elaborate and high-efficiency mulling equipment. Easier control.

Synthetic molding sand has the advantages of good uniformity and reproducibility of results, plus reduced mold wall movement and resulting higher accuracy of dimensional tolerances of castings. Today a few foundries are realizing the optimum performance from green sand. For many castings, quality obtainable in green molding sand is unsurpassed and it is the most economical manner in which to make a casting.

Veining and Penetration, by George Di Sylvestro, American Colloid Co., Skokie, Ill. Veining re-

EMPLOYER AWARD: On Oct. 21, Hamilton Foundry Inc., Hamilton, Ohio, was presented with the Ohio Rehabilitation Association's annual Employer Award for leading the companies of Ohio in outstanding contributions toward the rehabilitation of handicapped persons during 1959. Peter E. Rentschler, president, Hamilton Foundry Inc., left, is shown accepting the award from K. W. Hamilton, Ohio Rehabilitation Center, Columbus

USE DELTA FOUNDRY PRODUCTS TO IMPROVE QUALITY OF SILICATE PROCESS CASTINGS... and GET THESE *Bonus* RESULTS...

1. IMPROVE SAND COLLAPSABILITY

2. GET BETTER CASTING FINISH

3. IMPROVE FLOWABILITY OF THE SAND

4. GET BETTER PARTING

5. MAINTAIN DIMENSIONAL STABILITY

6. ELIMINATE HOT TEARS

7. INCREASE SHELF-LIFE OF CORES

While Delta Silicate Binders are the finest available, they are not universally adapted to all applications. This is true of *all* silicate binders. Delta research has established that for different sizes and types of castings the quality of the finished casting is dependent upon the controlled use of Delta Sand Additives in the sand mix. Delta technicians are qualified to recommend sand mixes, sand additives and procedures to enable you to get the benefits and bonus results you want in your silicate process casting operations.

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Circle 635 on Page 53

sults from thermal movement of the sand. While these veins normally can be removed by grinding, frequently they are at spots which are hard to reach. Production of test castings which result in veining conditions was described.

Cupola Operation with a Basic Lining, by W. W. Kerlin, Meehanite Metal Corp. Advantages of the basic lining include: 1. A 20 per cent reduction in coke consumption. 2. Reduction in pig iron ratios under certain conditions. 3. Cleanliness of the metal. 4. Reduction in sulfur.

These advantages, which may be offset in part by the higher cost of the basic lining, are not obtained without improved techniques. Melting loss for manganese is less, but is more for silicon. The amount of basic patching materials used will vary from 23 to 80 lb of stabilized dolomite per ton of iron melted. The number of heats that the basic brick work will resist varies from 60 to 750 heats. This wide variation points up the many variables that influence economies in this practice.

"Gesundheit!"

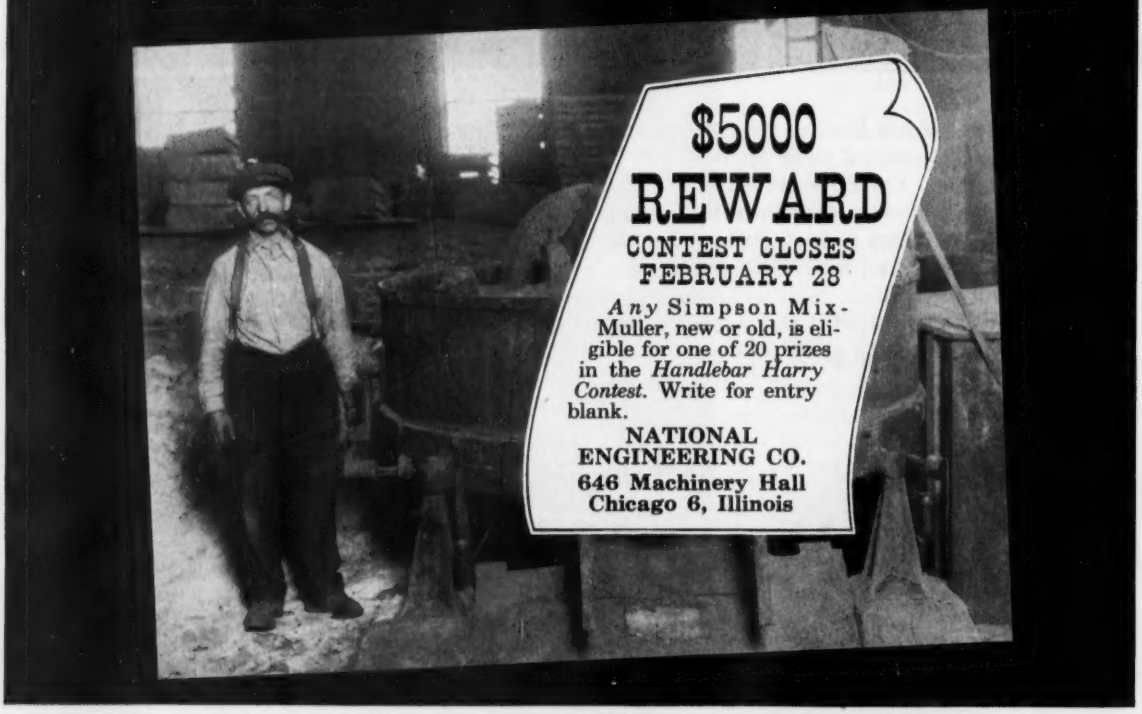
Production of Ductile Iron, by Ralph A. Clark, Union Carbide Metals Co., Cleveland. Development of the various grades of high-strength cast irons, including alloy grades, the acicular irons, and ductile iron, was discussed. In production of ductile iron, use of the plunging method in which the magnesium alloy is placed in a refractory bell or cage and plunged to the bottom of the ladle of iron, offers the advantage of reducing the amount of alloy required by about one half. It also standardizes the magnesium treatment and permits better control of metal properties.

Development of Aluminum Alloys and Casting Practices, by E. V. Blackmun, Aluminum Co. of America, Pittsburgh. New casting alloys developed in recent years provide improved mechanical or physical properties and other end-use characteristics. These new compositions include A140 and X250 sand casting alloys, C355 and A356 permanent mold high-strength alloys, and 364 and X385 diecasting alloys.

Improved furnace equipment and melting practices have resulted in less porosity in castings. The vacuum density test provides close control over the effect of melting, pouring, and gating practices on extent of porosity in castings. Casting quality also has been improved through greater availability and use of fluxes and grain refiners.

Special casting techniques in pro-

WHO'S GOT HANDLEBAR HARRY?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duction of permanent mold aluminum castings have resulted in parts which often satisfy requirements as well as would the more costly aluminum alloy forgings or fabricated parts. In addition, vacuum techniques have improved the quality of aluminum alloy diecastings.

Bronze Melting, by Ray Cochran, R. Lavin & Sons Inc., Chicago. High melt quality requires use of clean, dry material; moisture-free furnace and ladle linings and tools; the shortest possible charging and melting cycle; an oxidizing atmosphere, and use of lowest operating temperatures consistent with other phases of casting practice.

Fundamentals of the CO_2 Molding Process, by E. A. Lange, U. S. Naval Research Laboratory. The rate at which strength develops with CO_2 gassing depends on the SiO_2-Na_2O ratio of the sodium silicate. The maximum strength developed depends on the SiO_2-H_2O ratio of the sodium silicate.

The amount of CO_2 necessary to develop maximum gassed strength is that required to increase the SiO_2-Na_2O ratio of the sodium silicate to 4. At low CO_2 flow rates, however, the sodium silicate will absorb an amount of CO_2 equivalent to 1 to $1\frac{1}{2}$ times the amount of Na_2O present.

Quality Control and Nondestructive Testing of Nonferrous Castings, by J. W. Clarke, General Electric Co., Erie, Pa. Maintenance of casting quality requires controls starting with the initial use of raw materials and proceeding up to the finished, inspected casting. Various methods of nondestructive testing are useful in maintaining these controls.

Gating and Risering of Bronze

NEW FOUNDRY ENGINEERING FIRM FORMED

Brown Metals Engineering Inc., 300 Huron St., Elyria, Ohio, has been formed to provide the foundry industry with engineering assistance on plant layout, melting equipment and practice, metal handling, metallurgy, and process control.

The new company was formed by the Brown Thermal Products Corp., manufacturer of Brown hot blast heaters, and will take over the sale of these cupola heaters.

President of Brown Metals Engineering is John W. Brown Jr., president of Brown Fintube Co., Brown Thermal Products Corp., and Brown Fintube Canada Ltd. Mr. Brown spent the first 12 years of his industrial career as a metallurgist and alloy specialist for the foundry industry.

Arthur C. Buesing has been named vice president. He joined the Brown organization a year ago after spending two years with the Gray Iron Research Institute, Columbus, Ohio. Previously he had many years experience in foundry management, engineering, and metallurgy.

Director of engineering is F. T. Kaiser, formerly director of development engineering with Modern Equipment Co., Port Washington, Wis. A graduate of Marquette University, his industrial career has been devoted to engineering and the design of foundry equipment.

JOHN W. BROWN JR.

ARTHUR C. BUESING

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Circle 637 on Page 53

Castings, by N. A. Birch, National Bearing Div., American Brake Shoe Co., St. Louis. Although there are certain general rules for design of gating, the system for each casting should be devised to suit its particular requirements. The gating should permit the mold cavity to be filled in a reasonable time. Provision should be made to trap slag and dirt by providing a ratio of ingates to runner to down sprue areas of 1-2-1 plus. Streamlined flow of metal bottom gating and gating through risers are desirable and should be used whenever possible.

Risers should be designed to keep the needed volume of metal liquid long enough to feed the casting. A suitable temperature gradient should be established from the casting to the riser so that the liquid volume can get to the casting. The risers should be designed for relatively simple removal in the cleaning room.

Recent Developments in Magnesium Foundry Practice, by J. G. House, Dow Metal Products Co., Midland, Mich. Magnesium castings are being applied to a steadily broadening range of designs and applications. Such uses vary from precision castings weighing less than an ounce to the 1450 lb base for guided missile use.

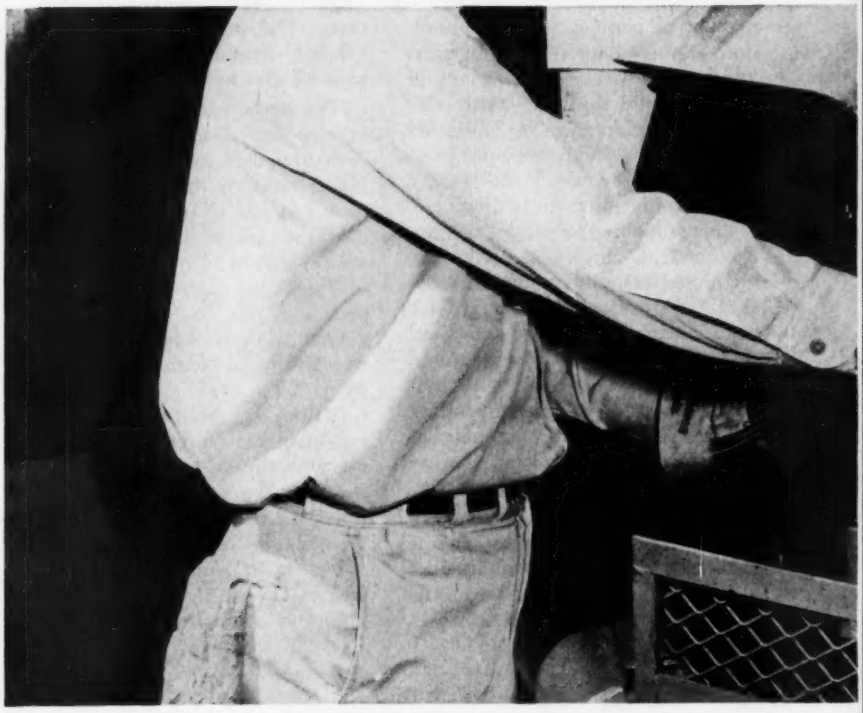
Some problems are encountered in casting magnesium with the newer molding processes. CO_2 molds, for instance, give poor collapsibility and poor surface finish. Shell molds also have poor collapsibility in casting magnesium, but good results are obtained on other counts. This is particularly true of small cross-sectioned castings.

Financial Management Subject Of Malleable Conference

A unique Conference on Financial Management, held recently at Chicago by the Malleable Founders Society's Accounting Committee, is to be repeated this spring.

A case history detailing the problems of the mythical "Seth Boyden Malleable Foundry Company" served as the basis for discussion at the Chicago conference.

Those attending were divided into groups of seven or eight to act as the company's board of directors. Among the problems facing the



ONE EVERY 30 SECONDS—Mold halves bonded with Durez resin come off this four-station shell molding

Which shell-mold resin is right for high-volume foundry?

Step into one of the country's most highly mechanized foundries and look around.

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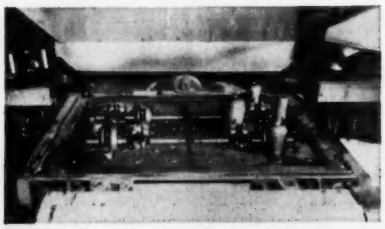
This foundry uses Durez resins exclusively for shell molds. Evinrude foundrymen get dependable production with Durez. It lets machines work at top capacity. It's always dependable—from shipment to shipment, from month to month.

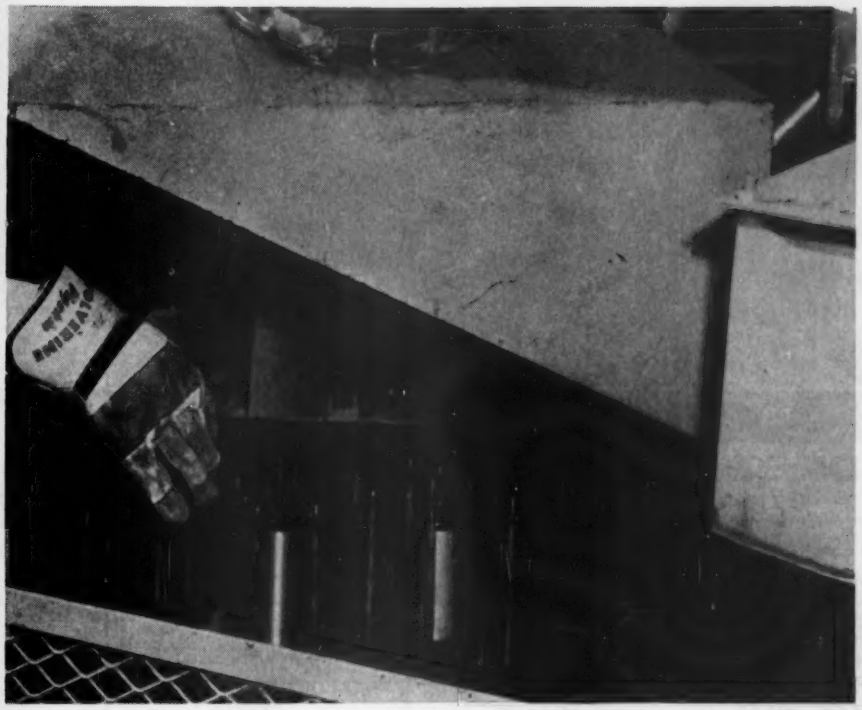
Your experienced Durez man can show you what Durez uniformity means to you—in terms of more production shell-mold operations in your own foundry. He can point out how you get less of *every* shell-molding problem when you work with Durez resins—and more of the accuracy and speed that shell molding gives you. Call him in soon.

New 32-page "Guide to Shell Molding"
Complete manual—contains recommendations on patterns, materials, mixing, temperatures, lubricants, molds, cores. Written by Durez men who have worked with shell molding for years. Yours free—just write for it.

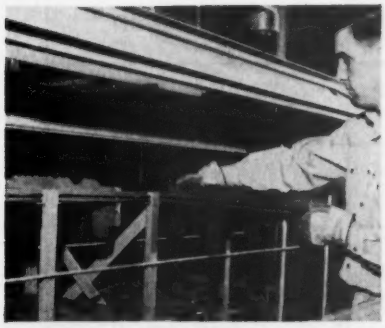


1. PATTERN produces cope and drag at the same time. Link-Belt molding unit has four patterns which rotate into position automatically.

2. DRAG HALF of mold, left, goes to belt conveyor for core setting. Cope goes directly to closing machine, which is synchronized with shell-molding unit.



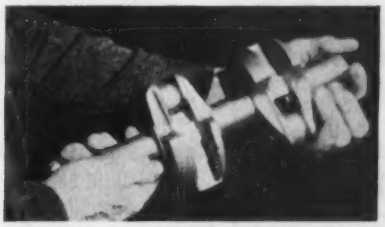
machine at Evinrude Motors foundry in Milwaukee. Production rate is 120 molds per hour.



3. CLOSED MOLDS go first to one of 52 storage cars that can hold 832 molds . . .

5. MELTING is continuous, with a tap ready every 20 minutes. Pouring platform travels at same speed as mold conveyor.

4. . . . then out of storage to trays of overhead trolley conveyor onto which backing sand has been vibrated automatically.



6. SHOT-BLASTED, HEAT-TREATED CASTING needs very little machining, uses less steel than previous forging, and has better wearing qualities.

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Circle 638 on Page 53

"boards" were declining market penetration, outmoded production facilities, long and short term sales and financial forecasts, and stockholder relations. The groups were asked to evaluate the company and develop a plan of action, expressed mainly in financial terms.

Harold E. Gray, director of the Michigan State University Continuing Education Center at Benton Harbor, Mich. was the conference leader, and Richard Spaid, assistant to the product manager, Coldspot Sales, Whirlpool Corp., Evansville, Ind., served as resource expert.

At the second conference planned for this spring, the various methods of evaluating capital investment proposals will be studied. The same case history method will again be employed.

Chicago Area Gray Iron Group Elects at Quarter Meeting

Robert H. Lehmpuhl, president, Sheffield Foundry Co., Chicago, is the new chairman of the Chicago Area Management Executives Group of the Gray Iron Founders' Society. He succeeds Harold W. Johnson, vice president, Wells Mfg. Co., Skokie, Ill.

New vice chairman is Charles A. Daugherty, vice president, T. L. Arzt Foundry Co. Re-elected secretary is C. V. Adams, secretary, Vulcan Iron Works Inc.

These officers for the coming year were named at the group's quarterly meeting at the Graemere Hotel.

Guest speaker was Arthur W. Goettler, assistant director of business research and statistics, Chicago Association of Commerce and Industry, and his subject "The St. Lawrence Seaway and the Effect on Chicago Area Business."

The speaker stated that the long-range effect of the seaway will be to increase both exports and imports. To date, the sharp gain in iron and steel imports is headlining the news and is causing concern in metals circles. Mr. Goettler explained, however, that part of the rise in imports must be attributed to the 1959 steel strike and also to an improved economic situation in Europe. He mentioned that the fact the seaway is closed in the winter will present a problem to manufacturers wishing to export.

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	FOUNDREZ 7600, 7601, 7605	LIQUID AMINO CORE BINDING RESINS	RAPID COLLAPSIBILITY FAST BAKE — LESS SMOKING
	CO-RELEES 7300	LIQUID SAND CONDITIONER	EXCELLENT SAND WORKABILITY
	coRCIment 7990, 7991, 7992, 7993	LIQUID OLEORESINOUS CORE BINDERS	BROAD BAKING RANGE
	FOUNDREZ 7150, 7151	LIQUID PHENOLIC RESINS FOR SHELL COREMAKING	UNUSUAL STABILITY
	FOUNDREZ 7500, 7504, 7506, 7555	POWDERED PHENOLIC RESINS FOR SHELL MOLDING	SELF-ACTIVATION
	FOUNDREZ 7520	GRANULATED PHENOLIC RESIN FOR SHELL MOLDING	HIGH TENSILE STRENGTH
	COROVIT 7201, 7204	POWDERED ACCELERATORS FOR COROVIT OILS	NON-TOXICITY
	COROVIT 7202, 7203	LIQUID BINDERS (SELF-CURING)	EXCELLENT FLOWABILITY
STEEL STAINLESS LOW CARBON HIGH CARBON	**FOUNDREZ** 7104	LIQUID PHENOLIC CORE BINDING RESIN	EXCEPTIONAL STABILITY HIGH HOT STRENGTH HIGH BAKED STRENGTH
COPPER ALLOYS BRASS BRONZE	**FOUNDREZ** 7605	LIQUID AMINO CORE BINDING RESIN	FAST BAKE LESS SMOKING
LIGHT ALLOYS ALUMINUM MAGNESIUM	**FOUNDREZ** 7605	LIQUID AMINO CORE BINDING RESIN	RAPID COLLAPSIBILITY

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PATENTS of Interest to Foundrymen

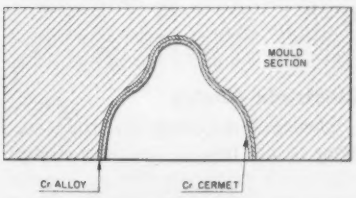
Bright Dipping Zinc Alloys

Describes method of imparting a bright surface finish to zinc-base alloys containing upward of 80 per cent Zn. Method consists of dipping them for a short time in an aqueous solution containing by weight 6.5 to 20.0 per cent chromic anhydride, 2.7 to 15.0 per cent nitric acid, 1.0 to 8.0 per cent hydrofluoric acid, and water to make 100 per cent. *Patent No.* 2,904,413 *granted to K. R. Hampel and assigned to Jervis Corp.*

Mold and Chill Coating

Invention in the accompanying illustration is a method of coating a metal chill or permanent mold to eliminate welding of the casting metal to the mold walls and to insure long service life. Procedure consists essentially of application of two different highly refractory coatings, but intermediate coatings also may be used.

Coatings are applied in the molten state by a high-temperature blowpipe. First coating may be a metallic alloy rich in Cr with or without Mo, W, Co, or a cermet containing up to 20 per cent Al_2O_3 and the remainder Cr-rich alloy. Last coating is a cermet containing 50 to 90 per cent Al_2O_3 and 10 to 50 per cent of a metal component con-



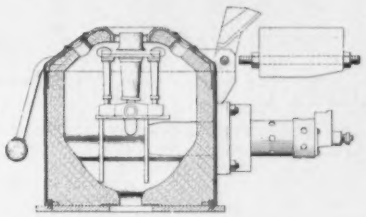
taining 70 to 100 per cent Cr. *Patent No.* 2,903,375 *granted to Lucien Peras and assigned to Regie Nationale des Unsines Renault.*

Alloy for Drawing Dies

Describes composition, effect, and preparation of a ferrous alloying agent for addition to zinc-base alloys. It is claimed to provide high wear resistance to zinc-base alloys in drawing dies. The agent consists essentially of 55 to 80 per cent Fe, 12 to 25 per cent Zr, and 8 to 20 per cent Al, wherein the ratio of Zr to Al is about 1.6:1. To insure solution in the zinc-base alloy, material is dissolved in molten copper to form an intermediate pre-alloy containing about 1.5 to 11 per cent Zr, 0.8 to 8 per cent Al, 5 to 35 per cent Fe and remainder Cu. From 3 to 6.5 per cent of the pre-alloy is added to the zinc-base alloy. *Patent No.* 2,908,564 *granted to R. F. Thomson and J. C. Holzwarth and assigned to General Motors Corp.*

Ceramic Mold Heating

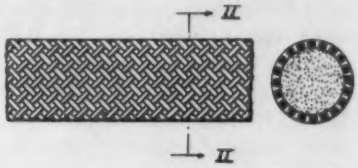
Device in accompanying illustration is designed to bring ceramic shell investment molds up to pouring temperature of 1400 to 2200° F, and contain them during the pour-



ing operation. Burner develops a pulsating flame providing 1200 to 40,000 pulsations a minute, controlled by the compressed air entering the burner. Pulsating flame causes a slight jarring motion, claimed to result in more rapid heating of the mold and reduce grain size of the molten metal poured therein. *Patent No.* 2,903,760 *granted to T. E. Millard and assigned to Thompson Ramo Wooldridge Inc.*

Cores Form Passageways

Hollow collapsible core is intended to form passageways or relatively small cross section in metal castings. Core is woven or braided fiber glass similar to that used in covering electrical wires and ranges from 1/32 to 1 in. in diam. Core is treated or coated with stiffening material such as tung oil, core oil, linseed oil, resins, acrylic acid, etc., and baked to harden the coating.



Suitable coating material is acrylic acid, which yields little or no gas in contact with molten metal. The treated core is filled with dry silica sand or other granular refractory, and additionally may be coated with a refractory wash containing graphite, talc, French chalk, etc. to obtain exceptionally smooth surfaces. After serving its purpose the core is withdrawn intact from the casting. *Patent No.* 2,907,084 *granted to R. T. Wood and assigned to Aluminum Co. of America.*

Vacuum Diecasting

This patent describes a method of making a movable enclosure or hood to surround the dies of a diecasting machine. The hood forms a chamber which can be evacuated prior to injecting the metal into the dies.

In addition, the equipment then is arranged so that the molten metal is subjected to the vacuum and any gases are removed before injection into the dies proceeds. *Patent No.* 2,904,861 *granted to D. M. Morgenstern and assigned to Package Machinery Co.*

Steel Slag Treatment

This patent relates to manufacture of basic open-hearth steel and is concerned with treatment of the slag to maintain it in a desirable fluid state. Slag is shaped up with addition of 2 to 20 lb anhydrous calcium chloride per ton of steel. Material reportedly increases the rate of car-

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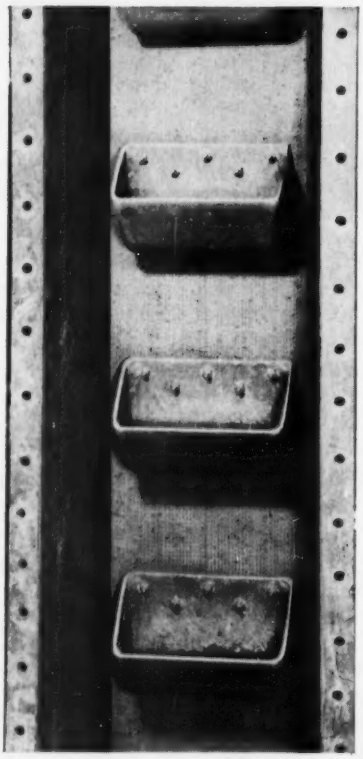

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bon reduction in the bath, and indicates that iron ore additions can be reduced 25 lb per ton of steel. It is claimed that use of calcium chloride does not pollute the atmosphere in the vicinity of the furnace. *Patent No. 2,907,652 granted to R. J. Anderson and assigned to Dow Chemical Co.*

Copper-base Alloy

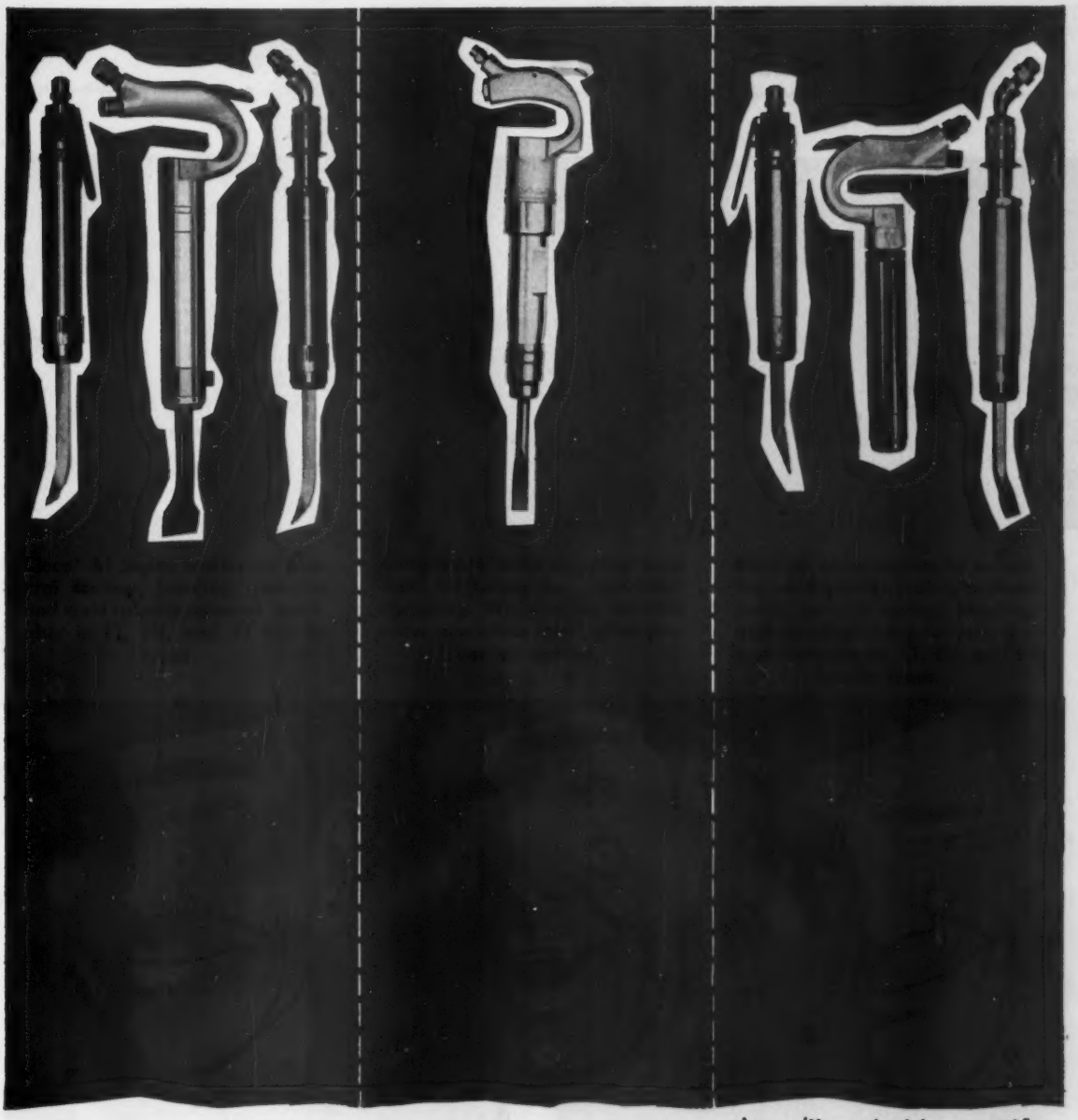
Details of composition, effect and method of producing a copper-bearing alloying agent are discussed. Alloying material is designed for addition to zinc-base alloys to provide high wear resistance in such applications as drawing dies. Copper-base alloying agent contains approximately 6.5 to 40 per cent Fe, 0.8 per cent Ti, 0.5 to 6 per cent Al, and the remainder substantially Cu. From 3 to 6 per cent of that alloy is added to the zinc-base alloy. *Patent No. 2,907,653 granted to J. C. Holzwarth and R. F. Thomson and assigned to General Motors Corp.*

Sulfur Removal from Iron

Method involves injection of finely divided lime and/or other desulfurizing agent through bottom of vessel with nitrogen or other carrier gas. Carrier gas contains 0.3 to 2.2 lb per cu ft of the desulfurizer, this injected into the molten iron bath at the rate of 6.33 lb per 100 lb metal per minute, and the period of injection is about 3 minutes. Desulfurization of 90 per cent or better is claimed. *Patent No. 2,906,616 granted to Marc Allard, Bernard Trentini, and Lucien Wahl and assigned to Institut de Recherches de la Siderurgie.*

Electrode Joining

Device for joining electrode sections in arc furnace employs clamping means in conjunction with pneumatic or fluid drive motor to give partial clockwise revolution to the electrode. At end of the stroke, the grip is released, and the motor is moved counterclockwise to original position. The electrode then is reclamped and the cycle repeated until the electrode is screwed tightly to adjoining section. *Patent No. 2,903,494 granted to Walter Meffert and assigned to Demag-Elektrometallurgie G.m.b.H.*



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News Views

CLASSROOM TV: Closed circuit television gives all students closeup seats at foundry laboratory demonstrations of University of Illinois College of Engineering. Here, Prof. James L. Leach and assistant are pouring molten metal

WINNING CONVERSION: Dan H. Davis, left, and Jack T. Eccles, Rockford Machine Tool Co., Rockford, Ill., won $500 first prize in the 1959 Annual Design Contest of the Gray Iron Founders' Society with this conversion of a prototype machine tool casting originally designed in welded steel

FOUNDRYMAN HONORED: C. F. Swigert Jr., left, and Ernest G. Swigert admire a plaque installed at the Oregon Museum of Science and Industry, Portland, Oreg., to commemorate their father, the late C. F. Swigert, founder of Electric Steel Foundry Co., Portland. The sons are, respectively, board chairman of Esco and president of Hyster Co.

50 YEARS: Grant Brothers Foundry Co., Detroit, celebrated its 50th anniversary Dec. 6 with the help of this replica of a 1909 foundry ladle which poured champagne. Roy G. Ouelette, president, shows how it works to Edward F. Washington, one of the firm's first salesmen, who came out of retirement in Clearwater, Fla., to be at the celebration

let's look at the figures

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9. Minimum gas
10. Ample collapsibility

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Circle 641 on Page 53

Literature for Foundrymen

For More Information Use Reply Card—Page 53

Solidification and Heat Treatment

Reprint includes five articles on solidification and heat treatment which appeared in FOUNDRY, September, 1959. Symposium discusses the equilibrium phase diagram, aluminum, magnesium, and copper-base alloys, gray iron, steel, and malleable iron. — Editorial Dept., FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

For More Details Circle No. 406—Page 53

Snagging Wheels

Proper selection of snagging wheels for swing frame, floor stand, and portable grinding is discussed in Catalog PG-356. Safety practices and a table of starting grades for rough grinding operations are included. — Cincinnati Milling Products Div., Cincinnati Milling Machine Co., 4701 Marburg Ave., Cincinnati 9, Ohio.

For More Details Circle No. 407—Page 53

Foundry Facts

"Foundry Facts—Metal Casting of Brass, Bronze, and Aluminum" contains basic background information about the foundry industry as a place to work.—Crucible Manufacturers' Association, 11 W. 42nd St., New York 36, N. Y.

For More Details Circle No. 408—Page 53

Centrifugal Compressors

Single-stage scroll casing compressors are covered in Bulletin 16 B 6048 C, which includes a description of the bearing and shaft seal arrangements for the compressors, an impeller chart, and performance data.—Allis-Chalmers Mfg. Co., 864 S. 70th St., Milwaukee 1, Wis.

For More Details Circle No. 409—Page 53

Welding Equipment

Bulletin EW-209 describes and illustrates arc welding machines. The comprehensive 24-page catalog includes specifications on welding, induction heating, etc., Hobart Bros. Co., Troy, Ohio.

For More Details Circle No. 410—Page 53

Fabric Gloves

Six series of coated fabric gloves made by the company are presented in Bulletin S-7924. Chemical resistance chart and applications of the gloves are featured.—Safety Products Div., American Optical Co., Southbridge, Mass.

For More Details Circle No. 411—Page 53

Radiation Exposure

Reprint discusses the permissible rate of radiation exposure to industrial employees. Article is taken from *Living With Radiation*, published by the Atomic Energy Commission, May, 1959.—St. John X-Ray Laboratory, Califon, N. J.

For More Details Circle No. 412—Page 53

Aluminum Casting Alloys

Aluminum casting alloy data book lists latest government and society specifications relating to aluminum casting alloys. Booklet features a line chart arrangement to easily locate physical and chemical characteristics of the various alloys.—U. S. Reduction Co., P. O. Box 30, East Chicago, Ind.

For More Details Circle No. 413—Page 53

Conveyors

Engineering data, conveyor layouts, capacity tables, conveyor selection, and horsepower requirements are offered in Catalog 951. The 56-page booklet includes extensive use of photographs, drawings, and tables.—Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, Ohio.

For More Details Circle No. 414—Page 53

Blast Cleaning Abrasives

Bulletin 903-D offers performance and statistical data on blast cleaning abrasives. Charts and graphs illustrate the effect of abrasive size mixture, shot consumption averages, the percentage of wheel efficiency at which blast equipment is operating, and the relationship of abrasive price and consumption to actual cost.—Wheelabrator Corp., 1102 S. Byrkit St., Mishawaka, Ind.

For More Details Circle No. 415—Page 53

Did You Miss These?

Here is a list of popular literature items offered in recent months:

CASTING ALUMINUM — Reynolds Metals Co., Richmond 18, Va. Circle 401, Page 53.

PATTERN SHOP—Progress Pattern Co., Detroit 19, Mich. Circle 402, Page 53.

PLUNGING LADLES (Data Sheet 52759)—Industrial Equipment Co., Minster, Ohio. Circle 403, Page 53.

REFRACTORY PRODUCTS, Davis Firebrick Co., Oak Hill, Ohio. Circle 404, Page 53.

NICKEL ALLOYS FOR CASTINGS ("A Quick Guide to the Nickel-Containing Casting Alloys)—International Nickel Co., New York 5, N. Y. Circle 405, Page 53.

Air Blowers

Operating principles, construction details, and specifications of CleanAir blowers are contained in Bulletin 1009-13. —Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh 8, Pa.

For More Details Circle No. 416—Page 53

Bonding Mortar

Facts on how to select and properly use Kromtite, a chrome base, air-setting refractory bonding mortar, are presented in Bulletin 73.—Refractories Div., H. K. Porter Co., Porter Bldg., Pittsburgh 19, Pa.

For More Details Circle No. 417—Page 53

Compressed Air Circuits

Features, diagrams, operational explanation, and specifications of components that make up the company's combination units for compressed air circuits are described in Circular 1014.—Wilkerson Corp., 1650 W. Girard, Englewood, Colorado.

For More Details Circle No. 418—Page 53

Pattern Letters

Catalog describes and illustrates styles and sizes of letters and numerals made by the company. Price list for pattern letters also is included.—H. P. Maughlin Co., 953 Ingleside Ave., Columbus 8, Ohio.

For More Details Circle No. 419—Page 53

Adjustable Nozzle

Duel-Nozzle suited for diecasting operations is featured in Bulletin N-186. The advantages of the nozzle are described, and specifications and price list are included.—Columbus Automatic Lubrication Co., 81 E. State St., Columbus 15, Ohio.

For More Details Circle No. 420—Page 53

Silicone Release Agents

Benefits of silicones in diecasting, ingot molding, investment casting, and shell molding operations are discussed in Bulletin No. U-5-100. — Dow Corning Corp., 592 Saginaw Rd., Midland, Mich.

For More Details Circle No. 421—Page 53

Heat Treating Units

Six-page technical Bulletin T-19-C contains cross-sectional drawings of the company's heat treating units. Included are performance facts and specifications.—Ipsen Industries Inc., 721 S. Main St., Rockford, Ill.

For More Details Circle No. 422—Page 53

Industrial Trucks

Five-page article in the company's publication, *Lift for Industry*, provides figures covering the relative cost of opera-

In 18,000 working hours, only 25 hours downtime

for 3 Michigan Tractor Shovels at Benjamin Harris & Company

This well-known Chicago Heights firm bought three 16 cu ft Michigan Model 12B Tractor Shovels for its brass and bronze refinery, had them converted to LP gas for low-cost maintenance. Harris officials *expected* operating efficiency—but hardly the dramatic results they got! In 23 months—with each Michigan running at least 60 hours per week—*operating availability ran better than 99%!* Out of 18,000 assigned working hours, only 25 hours were lost for repairs!

According to John Schoenfield, Harris' general foreman, even this small amount of downtime had nothing to do with Michigans' running parts. About 10 hours went into welding a cracked counterweight frame (inexperienced operator rammed the wall). The other 15 hours involved replacing the $1.50 vacuum switches which meter LP gas into the carburetors (switches wear out every couple of months).

No repairs to power train

"We haven't touched the engines, torque converters, power-shift transmissions or axles," Mr. Schoenfield continues. "All we've done is pull the regular check recommended by the manufacturer. For every 40 hours of operation, we devote about an hour after the normal work shift to checking oil, greasing fittings and cleaning air filters. Our service shop's monthly report hardly ever mentions Michigans."

Move 750 tons a day

Harris doesn't "baby" the Michigans either. They're pushed all day long. Production runs roughly 75 tons per day—15 of black (blister) copper, about 60 tons of specification brass and bronze ingots. To turn it out, *more than ten times as much raw material*—about 750 tons—must be charged into the furnaces daily.

Raw material? Almost anything!

Scrap comes in by rail or truck—includes nearly anything containing copper. Empty cartridge cases, old electric cable, broken auto batteries, bulk mill residues, etc. Michigans unload this raw material, store it in hundreds of tote-boxes or charge it directly into furnace hoppers.

Where men can't breathe, Michigans must

Their job often requires the fast, compact Michigans to work in and out of boxcars, handling smoky, sooty residue that boils up in choking clouds. Operators must wear special respirators—but the Michigans, with power trains fully enclosed, need no special protection. Unloading a typical 50 ton boxcar takes one of the 16 cu ft Michigans less than 2 hours.

Odd jobs a specialty, too

These Tractor Shovels also tow steel-wheeled carts, spot railroad cars, shovel snow. They've pulled lift trucks back out of muddy yards on to platforms. They've poured concrete for patch-up work and backfilled around construction. They have even loaded brass and bronze ingots into low-headroom haul trucks, where fork lifts couldn't enter.

Demonstrate? Glad to!

Your local Michigan Distributor has dollar-*and-sense* case histories of Michigan Tractor Shovels in situations just like yours. Ask him to show you—on paper *and on the job*. Nine basic models, 16 cu ft to 6 cu yards; with buckets and attachments to fit any need.

Michigan is a registered trademark of
CLARK EQUIPMENT COMPANY
Construction Machinery Division

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Circle 642 on Page 53

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Circle 643 on Page 53

tion and maintenance of new and rebuilt industrial truck models. Charts and graphs are included.—**Elwell-Parker Electric Co.**, 4205 St. Clair Ave., Cleveland 3, Ohio.

For More Details Circle No. 423—Page 53

Hoist Specifications

First of a series of recommended minimum standard hoist specifications deals with hoists of electric wire rope type.—**Hoist Manufacturers Association Inc.**, One Thomas Circle, Washington 5, D. C.

For More Details Circle No. 424—Page 53

Sling Chain Safety

Guide on sling chain safety is comprised of five folders, each dealing with a different aspect of the subject. Covered

are care and inspection programs, working load limits, and maintenance procedures.—**McKay Co.**, 1005 Liberty Ave., Pittsburgh 22, Pa.

For More Details Circle No. 425—Page 53

Organic Binder

Leaflet describes Bondite, the company's organic binder for skin dry, dry sand, and green sand molds and cores.—**Delta Oil Products Co.**, 6263 N. Cedarburg Rd., Milwaukee 9, Wis.

For More Details Circle No. 426—Page 53

Self-Dumping Hoppers

Four-page bulletin explains advantages and applications of company's self-dumping hoppers. Specifications and designs are given.—**Apex Welding & Fabricating Corp.**, 30 Interstate St., Bedford, Ohio.

For More Details Circle No. 427—Page 53

Compressed Air Fundamentals

Booklet 1548 covers single and two-stage compressors, their construction and operating features, and general information on use of compressed air.—**Ingersoll-Rand**, 11 Broadway, New York 4, N. Y.

For More Details Circle No. 428—Page 53

Premixed Mortar

Bulletin EPMM-4 outlines and illustrates the application of Embeco premixed mortar.—**Master Builders Co.**, 7016 Euclid Ave., Cleveland 3, Ohio.

For More Details Circle No. 429—Page 53

Fireclay Brick

Bulletin presents advantages of Erie brick. Test data and a diagram of various methods of construction of linings for car-type hot metal transfer ladles are included.—**North American Refractories Co.**, National City Bank Bldg., East Sixth Street, Cleveland 14, Ohio.

For More Details Circle No. 430—Page 53

Casting Alloys

Two reprints are available of discussion before the American Society for Testing Materials concerning mechanical and physical properties of three low-shrinkage, copper-base casting alloys. Reprints include photomicrographs, structural change tables, and data on tension studies, impact energy, and rupture time.—**Brass & Bronze Ingot Institute**, 308 W. Washington St., Chicago, Ill.

For More Details Circle No. 431—Page 53

Chemical Products

Thirty-six page catalog lists specifications, end uses, and technical data about basic chemicals, monomers, polymers, resins, adhesives, coating materials, plastic products, fine chemicals, organic intermediates, and biochemical reagents.—**Borden Chemical Co.**, Dept. H, 350 Madison Ave., New York 17, N. Y.

For More Details Circle No. 432—Page 53

Induction Heating Equipment

Fifty-two page catalog covers wide range of induction heating equipment for hardening, brazing, soldering, forging, and annealing. The handbook outlines major equipment and services.—**Induction Heating Corp.**, Dept. PR-2, 181 Wythe Ave., Brooklyn 11, N. Y.

For More Details Circle No. 433—Page 53

Combustion Safeguard

Protectofier combustion safeguard control for heating and heat treating applications is described in Bulletin 659.—**Protection Controls Inc.**, 6000 N. Legett Ave., Chicago 46, Ill.

For More Details Circle No. 434—Page 53

Aluminum Casting Alloy

Design and foundry information on Tens-50 aluminum casting alloy are given in booklet, including helpful charts and graphs which show detailed advantages and specifications.—**Navan Products Inc.**, 900 N. Sepulveda Blvd. at Imperial, El Segundo, Calif.

For More Details Circle No. 435—Page 53

Steel Shot

Booklet 2294 covers important factors in selection of steel blast cleaning abrasives. The 20-page booklet devotes a section to the methods of quality control used to test each shipment of steel abrasive.—**Pangborn Corp.**, Hagerstown, Md.

For More Details Circle No. 436—Page 53

Gamma Radiography

Twenty-four page bulletin NS-2000 covers gamma radiography and nucler system services. Selection of sources and equipment for radiography are explained, and methods of exposure and typical

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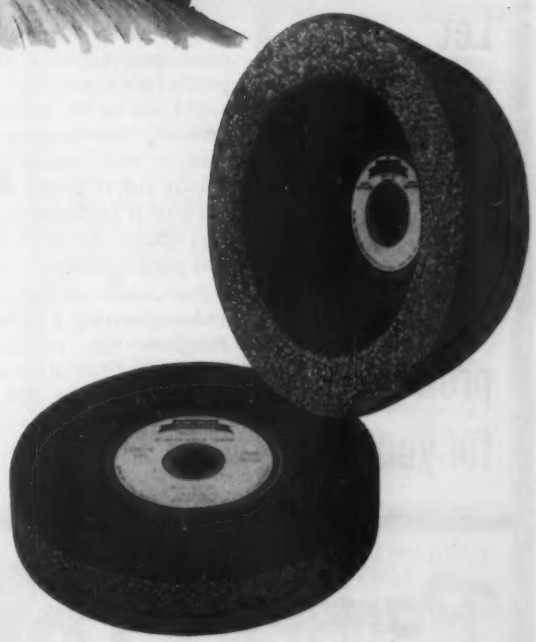

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Write for Bulletin ESA-304

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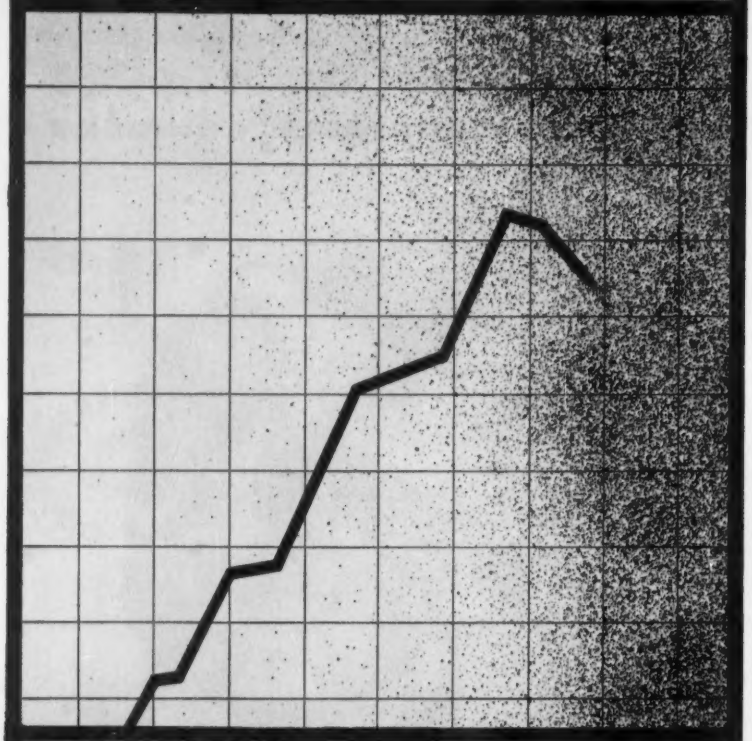
IS DUST DIMMING YOUR PROFIT PICTURE?



Let Pangborn Dust Control chart new profits for you!

If you have uncontrolled dust in *your* plant, you automatically have reduced profits! It's a matter of simple arithmetic —just add up the cost of lost salvageable material, housekeeping expenses, excess machine wear, intangibles such as community and employee goodwill. Whether the total is moderate or high, you'll find that efficient Pangborn Dust Control will cost you considerably *less!*

For details on Pangborn's experience and engineering knowledge, talk to the Pangborn man in your area or write PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Dust Control and Blast Cleaning Equipment —Rotoblast® Steel Shot and Grit.* ™

Pangborn CONTROLS DUST

radiographs are given.—Nuclear Systems Div., Budd Co., 2450 Hunting Park Ave., Philadelphia 32, Pa.

For More Details Circle No. 437—Page 53

Reduced-Voltage Starters

Bulletin GEA 6860 contains definition, use, and selection of reduced-voltage, motor-starting equipment.—General Electric Co., Schenectady 5, N. Y.

For More Details Circle No. 438—Page 53

Crucible Furnaces

Bulletin C-20A describes stationary and tilting gas-fired crucible furnaces. Technical data is given.—Hevi-Duty Electric Co., P. O. Box 563, Milwaukee 1, Wis.

For More Details Circle No. 439—Page 53

Haulage Machines

Book 2892 contains information on applications of car spotters and car pullers,

especially for moving railroad cars and barges. Typical layouts are shown.—Link-Belt Co., Prudential Plaza, Chicago 1, Ill.

For More Details Circle No. 440—Page 53

Electric Hoists

Twelve models of the S series heavy-duty, quick-lift hoists are described in Bulletin ADH-75. Specifications and illustrations are included.—Coffing Hoist Div., Duff-Norton Co., 800 Walter St., Danville, Ill.

For More Details Circle No. 441—Page 53

Air Filter

Bulletin 220 contains material about the company's new activated carbon disposable odor filter.—American Air Filter Co. Inc., Dept. PD, 215 Central Ave., Louisville 8, Ky.

For More Details Circle No. 442—Page 53

Nondestructive Testing

Folder describes and illustrates the nondestructive test systems available from the company.—Magnaflux Corp., 7300 W. Lawrence Ave., Chicago 3, Ill.

For More Details Circle No. 443—Page 53

Vacuum Equipment

Product summary and price list classifies vacuum equipment and components.—NRC Equipment Corp., 160 Charlemont St., Newton 61, Mass.

For More Details Circle No. 444—Page 53

Course in National Security Offered by Armed Forces

A correspondence course, "The Economics of National Security," is being offered by the Industrial College of the Armed Forces to qualified civilians in business, industry, and the professions as well as to selected officers of the reserves and regular components. The course is based on the curriculum of the 10-month resident course conducted by the college and portrays the interdependence of the economic and military structures.

Text material is presented in 22 bound volumes of about 85 pages each and is organized into five units of study. Members of the faculty review each test paper submitted and are available to answer individual questions. The entire course takes about one year to complete. Reserve officers not on extended active duty are granted 48 credit points. Civilians completing the course receive a certificate of completion. There is no charge for the study. Interested personnel should apply to the Commandant, Industrial College of the Armed Forces, Washington 25, D. C., Attn: Correspondence Branch.

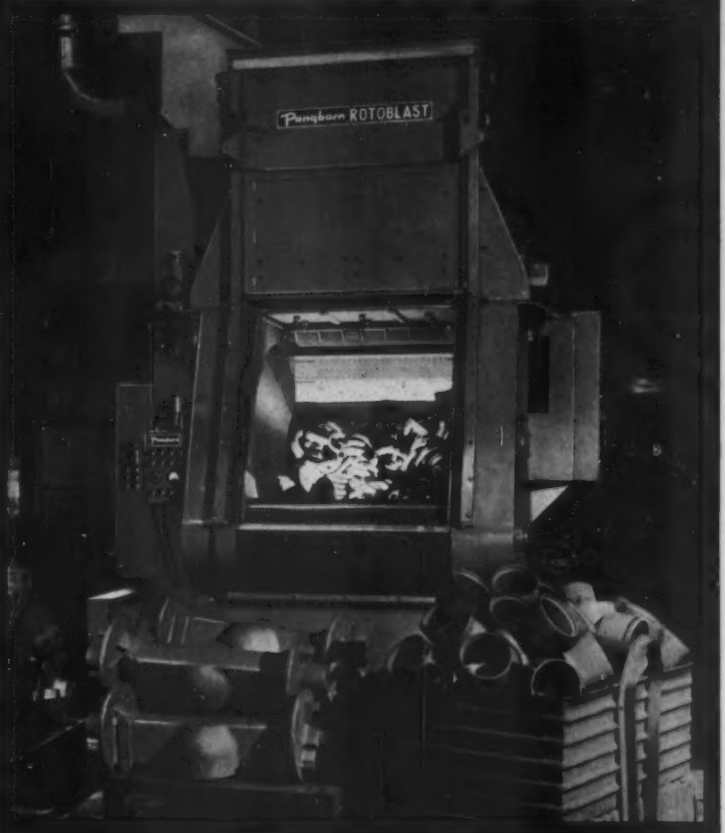
Aircraft Engineer Speaks to Investment Casters Society

At a meeting of the Investment Casters Society Oct. 20, Tom Carolan, Lockheed Aircraft Corp., spoke on "What the Aircraft Engineer Needs and Expects from the Investment Casting Industry."

He stated that a successful investment casting company needs an integral organization, qualified metallurgists, research on a society basis, and standardization of product and specification. He also recommended that the society use before and after pictures of negotiated designs as a sales tool.

In the way of solutions, Mr. Carolan suggested establishing more critical quality control, asking questions when there is doubt, improving confidence level in customers—eliminate the aircraft engineer who says castings are no good—and getting the right people at all levels within the organization. He also suggested that members urge their colleges to add casting courses.

CUTS MAN-HOURS 38%



Pangborn Rotoblast cuts man-hours per day from 24 to 15 at Meadville Malleable Iron

The investment in a new 20 cu. ft. Pangborn Rotoblast Barrel has really paid off for Meadville Malleable Iron Co., Meadville, Pa.! By switching from a competitive barrel of about 12 cu. ft. capacity, the firm now cleans loads three times as large in half the time. Today tote box loads averaging 1900 lbs. each are cleaned in 4—5 minute cleaning cycles. As a result, the Rotoblast Barrel has cut 24 man-hours per day to 15 man-hours in the cleaning department and greatly improved the quality of the work.

How much time and money can Pangborn Rotoblast save you? It would pay you to talk to the Pangborn man in your area. Or write PANGBORN CORP., 1400 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Blast Cleaning and Dust Control Equipment.*

Pangborn

CLEANS IT FAST WITH ROTOBLAST®

Between classes, students stopped at the display, inspected castings, and guessed the weight. Guesses were made by 128 students

To stimulate interest, the contest was announced in the student newspaper on the day before the competition took place

INDUSTRIAL ENGINEERING:
MECHANICAL ENGINEERING:
METALLURGY:

STUDENTS

GUESS, COMPUTE, ESTIMATE the weight of a casting from a modern ROCKET

Win Valuable Prizes!

1st Prize: Any 1 volume HANDBOOK
2nd Prize: $10 Cash
3rd Prize: Ticket to STANFORD GAME

All prizes doubled if winner is registered with
FOUNDRY EDUCATIONAL FOUNDATION

ENGINEER'S COURT
TUESDAY, October 6
9 a.m. to 4 p.m.

Guessing Contest Spurs Interest in

California FEF Program

● EACH YEAR an interesting contest is conducted at the University of California, Berkeley, to develop interest in the Foundry Educational Foundation program at that institution. The contest, open to students in industrial engineering, mechanical engineering, and metallurgy, consists of guessing the weight of a casting loaned by a local foundry.

The latest contest, held on Oct. 6, was announced in an advertisement in the student newspaper on the day before.

The casting was displayed in the Campus Court near both the Mechanical Engineering and Industrial Engineering Buildings. An attractive young lady provided information and collected the filled-in contest blanks. Between each class during the day many students stopped at the display, inspected the castings and made a guess. This fall 128 students entered guesses.

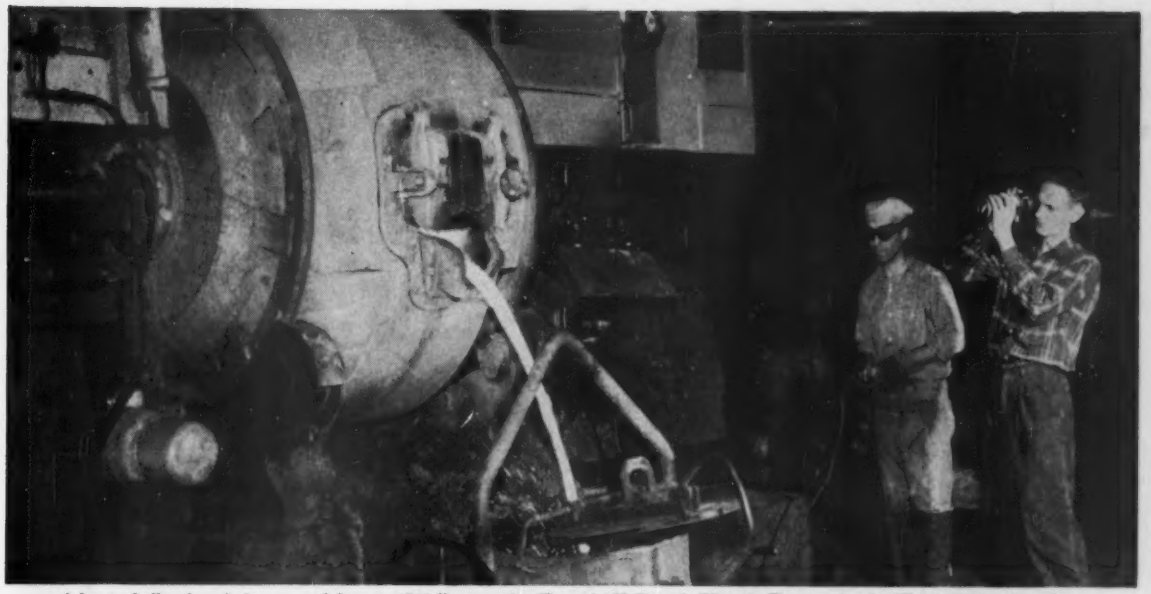
The casting used in the recent contest was an aluminum alloy missile part supplied by Donald C. Caudron, vice president, Pacific Brass Foundry of San Francisco Inc. and president of the Northern California Chapter of AFS.

The casting weighed 42.51 lb. The winning guess was 42.5 lb.

First prize was any one volume handbook, second prize $10, and third prize a ticket to the Stanford football game. All prizes were doubled if the winner was registered with the Foundry Educational Foundation.

The contest idea was developed by E. Paul DeGarmo, chairman, Department of Industrial Engineering.

This attractive young lady was on hand at the display to provide information about the contest and to collect filled-in entry blanks



A heat of alloy iron being poured from a 1500-lb. capacity Type AAH Detroit Electric Furnace in the Westinghouse foundry.

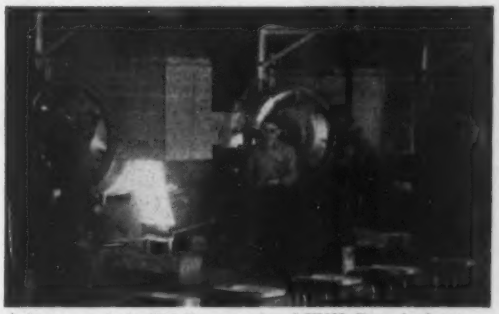
Nine Detroit ROCKING Electric Furnaces Melt Brass and Ductile Iron for Westinghouse Air Brake Co.

Brass, ductile iron, gray iron and special alloys are melted in the nine Detroit Rocking Electric Furnaces at the Westinghouse Air Brake Division foundry.

Whether your foundry produces one product or a variety of metals and alloys, Detroit Electric Furnaces can provide melts of consistent high quality and do it economically.

Detroit's indirect arc melting and automatic rocking action assure homogeneity and close analysis control through heat after heat. Using quickly interchangeable shells, a single Detroit Furnace can melt different alloys with a minimum of downtime. Simply exchange shells, set the desired melting cycle and the furnace is ready for charging. You get full utilization of furnace capacity plus high quality results.

Send us your operating data and our engineers will show you how Detroit Electric Furnaces can best meet your melting requirements.



A battery of six 750-lb. capacity LFYH Detroit furnaces melt bronze of more than a dozen specifications.

A Westinghouse man records a heat of ductile iron melted in Type AAP Detroit Furnace with motorized electrodes.

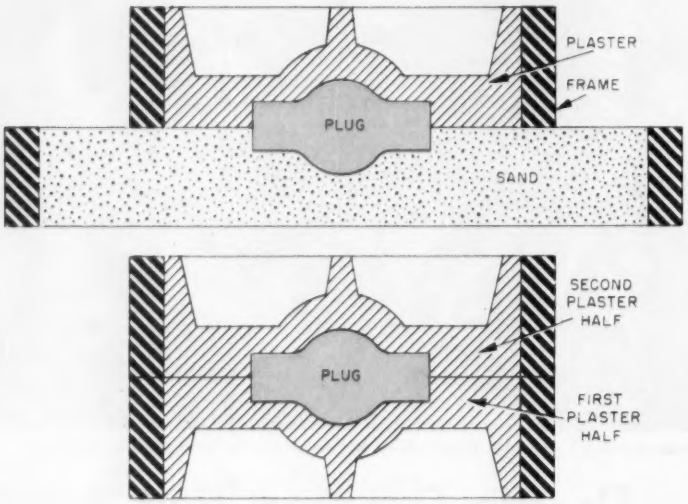
DETROIT ELECTRIC FURNACE DIVISION

Kuhlman Electric Company • Bay City, Michigan

Foreign Representatives: In BRAZIL—Equipamentos Industrias, "Elsa" Ltd., San Paulo; CHILE, ARGENTINA, PERU and VENEZUELA: M. Castellvi Inc., 150 Broadway, New York 38, N. Y.; MEXICO: Cia Proveedora de Industrias, S.A. Apartado Postal No. 2783, Mexico 7, D.F., Mexico.

Trouble Shooting

By C. W. AMMEN



Drawings show steps in construction of cast iron coreboxes for shell cores. Same method can be used for permanent mold cavities

Pattern and Core Plugs

Dear Charlie:

We have two problems, which are basically the same—casting permanent mold cavities and casting coreboxes for our shell cores. Both are made in cast iron and must be as smooth and as close to dimensions as possible. We have gone to a lot of trouble and made a complete set of patterns for one cavity, both sides in wood, only to find that the halves cast from these patterns are not matched or smooth enough.

Sincerely,
Sam

Dear Sam:

Making a set of patterns for a permold cavity or a set of corebox patterns in wood that will come out close enough to eliminate considerable trouble and finishing is a tough job—one which takes a very good patternmaker indeed. It can be done, however, and is being done every day. We will use the corebox pattern as an example; the permold problem is handled in the same manner.

The simplest method, the one used extensively by the folks who make cast iron coreboxes for shell core use, is the core plug method.

Let's say that the pattern to be used by the foundry is made of wood. As is the patternmaker's practice, he first makes a layout on a piece of wood showing the core, wall dimensions, etc.

The next step is to make a core plug from this original layout (the exact duplicate of the sand core, but in wood). The core plug is finished to high smoothness and accuracy, with continuous checks against the print and original layout. When the plug is finished, the parting plane is scribed completely around it with a sharp knife.

The plug then is placed on a smooth molding board, and a drag is positioned around it with plenty of room to spare. Ram the drag up tightly with a fine sand. Roll it over and cut a parting down to the scribed line indicating the parting plane. This parting must be done with great care and accuracy and must be slicked smooth.

The plug is drawn out with a minimum amount of rapping to check for correctness in making the parting and for any spots of back draft. It then is replaced, and any necessary repairs are made. The exposed surface of the plug should be parted with a good grade of melted kitchen shortening. Use a soft camel hair brush and allow the shortening to cool.

Next, place a wooden frame on the drag and make up one half of the corebox pattern with plaster or casting stone against the plug and sand parting. The back of the pattern can be made to follow the contour by cutting the plaster or by using wood ribs and forms set prior to working the plaster—whichever suits you best. After this half has hardened, it is removed from the sand drag, and the surface is cleaned and tooled up smooth. Let the plug remain in the plaster, and take care not to disturb the parting plane at the plug.

In each corner of the plaster, a female locater is cut. The plaster then is given a coat of liquid shoe polish (not shellac). When it has dried, the entire surface, plug and all, is given a coat of melted shortening. After that coat has dried, the other half is poured against this half, and the back is contoured as before. When they have hardened, the halves are separated, and the plug is removed. Both halves are

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STEEL TYPE ABRASIVES
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$155.00 *per ton*

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There's no need to pay a premium for small quantity orders of steel abrasives. METAL BLAST sells its "SEMI-STEEL" for a flat $155 per ton — in any quantity, one ton to a carload. (Prompt shipment, too, on any size order!)

You save, therefore, on material cost alone, from $50 to $100 a ton! But, that's not all! "SEMI-STEEL" cleans as well or better than other, higher priced steel abrasives. It lasts just as long. Easier on equipment, too, so your maintenance costs are lower. You just can't help but slash cleaning costs. And, we'll guarantee it — in writing!

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Inquire, too, about our free engineering service, lab tests and low prices on malleable and chilled abrasives.

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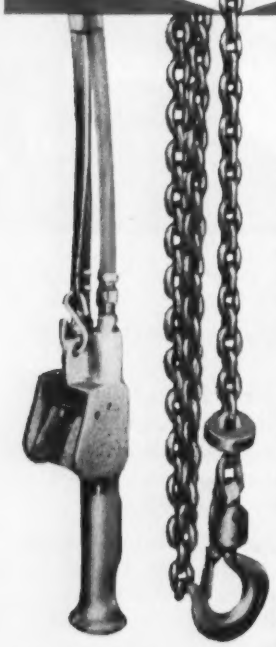
Faster Load Lifting With New Coffing Quik-Lift Air Hoist

12 MODELS
lift full load 10 feet
500-pound hoist— 7 seconds
1000-pound hoist— 9 seconds
2000-pound hoist—24 seconds



Speed, accurate control, safety and long life are combined in the new Coffing Quik-Lift Air Hoist to give you efficient hoisting power.

Smooth power flow and absolute control at all speeds and loads is provided by the heavy-duty, 8-blade rotary air motor, the air-cooled disc brake and sensitive controls.

This hoist will not drop its load if air pressure fails for the brake is always engaged except when the motor is activated. If air supply fails, load can be safely lowered manually by the brake adjustment screw. The air-cooled, disc-type brake provides four times as much braking area as conventional brakes.

Free movement so that the push-button pendent control is always correctly positioned for easy use is provided by the swiveling features of the air supply hose and pendent hoses. Safety hooks, which are standard equipment on all models, swivel on roller thrust bearings.

The Coffing Quik-Lift Air Hoist is available in 500, 1000 and 2000-pound capacities —with either link or roller chain and with interchangeable manual pull-cord or push-button pendent controls. Ask your distributor or write for Bulletin ADH-79.

COFFING HOISTS

DUFF-NORTON COMPANY

825 Walter Street • Danville, Illinois

COFFING HOISTS
Ratchet Lever • Air
Hand Chain • Electric

DUFF-NORTON

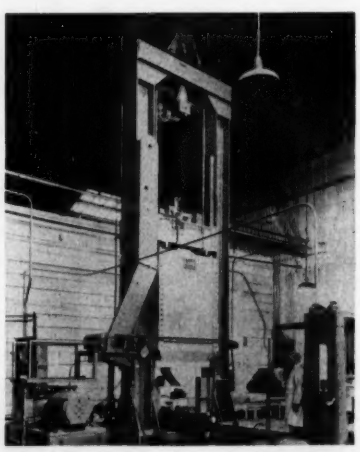
DUFF-NORTON JACKS
Ratchet • Screw
Hydraulic • Worm Gear

removed from the frames and are given a coat of liquid shoe polish all over both sides.

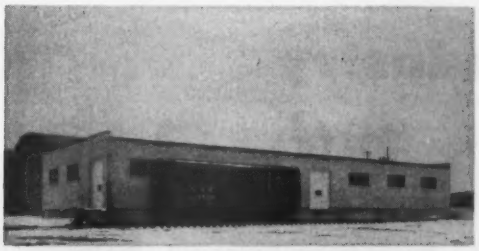
The corebox patterns then are ready for use. Both halves are molded for casting in gray iron in the conventional manner. To assure smoothness and close dimensional stability, try a facing of zircon sand bonded with bentonite and just enough corn flour to give the mix some resilience. If possible, both halves should be cast from the same ladle or tap. This practice helps to give them uniformity.

You will find that on many small boxes and cavities, the parting follower against which your first plaster is poured can be made with modeling clay instead of sand. Many a small gang corebox for bench work or blowing is produced from a plaster pattern made against a plug or gang of plugs.

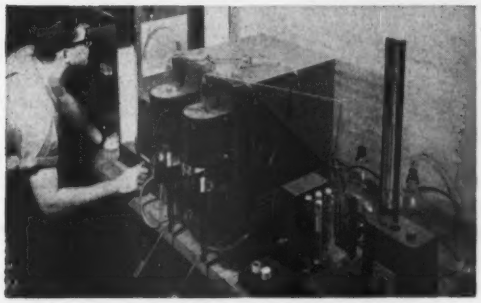
A plaster mold can be made from the original master plug and used to cast any number of identical plaster plugs for use in gang boxes. This method is used to make permolds of more than one cavity. Of course, the plug to make a permold cavity pattern represents the casting, not the core, and could be called a casting plug. Plugs are easier to make, being male, than are female wood patterns.



CASTING CONDITIONER: Elmes Engineering Div., American Steel Foundries, Cincinnati, designed this machine to build up initial capacity in a draft gear. Unit conditions rough-cast mating surfaces by dropping a 27,000-lb weight from varying, successively increasing heights



ANOTHER CMA IMPROVEMENT IN THE PRODUCTION OF METALLIC ABRASIVES



We are maintaining consistent improvement of our facilities, with one thing in mind . . . providing you with the best possible line of Persuasive Abrasives at the best possible price.

Evidence of this can be seen here.

The new Toledo addition is completed, providing us with necessary additional shipping room and better flow of basic materials.

Our new laboratory at Cleveland is complete and functioning in the direction of closer quality control.

Most importantly, ground has been broken on our new 16,000 square foot Cleveland addition. This will house electric melting furnace facilities producing 12,000 pounds of finished steel per heat. Other equipment includes modern conveyors, heat treating furnaces, tanks, and crushers.

All of these improvements add up to further your confidence in CLEVELAND as a central source for all types of metallic abrasives.

For further details, call in our nearby representative or send for our Catalog No. 159.

CLEVELAND is the name and the place for PERSUASIVE ABRASIVES

the CLEVELAND metal abrasive company

GENERAL OFFICE: 888 East 67th Street • Cleveland 3, Ohio • PLANTS AT Howell, Michigan; Toledo; Cleveland

World's Largest Production Capacity

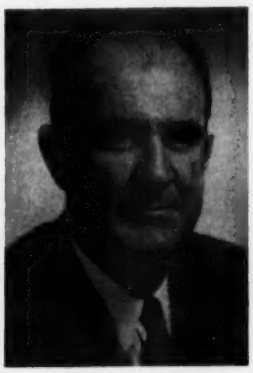
Teletype: CV 901

Circle 650 on Page 53

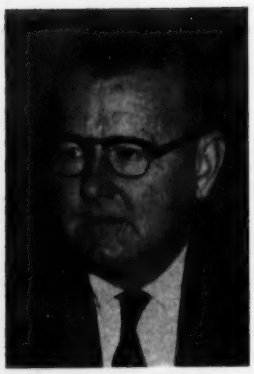
Men of Industry

ALBERT L. HUNT
. . . Superior Foundry executive

EDWARD N. HARRIS
. . . Bohn Aluminum plant mgr.



ELDEN AUKER
. . . heads wheel mfrs.



WARREN A. BROWN
. . . Florence Pipe pres.

Albert L. Hunt, formerly vice president in charge of operations, National Bearing Div., American Brake Shoe Co., St. Louis, has joined Superior Foundry Inc., Cleveland, as executive vice president. He spent 24 years with the division in production, sales engineering and management. Mr. Hunt is a former chairman of the St. Louis Chapter of the American Foundrymen's Society and a past national director. For several years he was chairman of the Industry Committee of the Foundry Educational Foundation for Missouri School of Mines.

Edward N. Harris has been named manager of the South Haven, Mich., plant, Bohn Aluminum & Brass Corp., Detroit. He formerly supervised the company's sales and engineering contacts with several manufacturing divisions of General Motors Corp., Detroit.

Clarence W. Rowsey has been named personnel and safety director, Hamilton Foundry Inc., Hamilton, Ohio. **Paul H. Roesch** has been made assistant pattern foreman.

Frank J. Gentile has been named chief engineer, Youngstown Foundry & Machine Co., Youngstown, Ohio. **Joseph A. Becker** has succeeded Mr. Gentile as assistant chief engineer. **Anthony P. Sgambati** has been made project engineer.

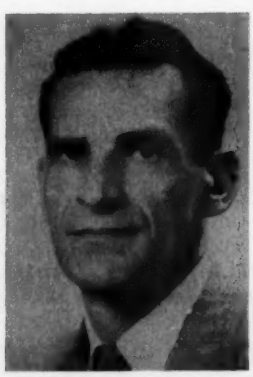
Elden Auker, vice president, marketing, Bay State Abrasive Products Co., Westboro, Mass., has been reelected chairman, board of directors, Grinding Wheel Institute. It is composed of 32 of the country's grinding wheel manufacturers.

E. Roy Russell has retired as president, Florence Pipe Foundry & Machine Co., Florence, N. J., and its subsidiary, R. D. Wood Co., Philadelphia, after 57 years with the parent company. He will be available as a consultant. **Warren A. Brown** has succeeded him as president of the two companies. Since 1954 Mr. Brown has been vice president of the Florence company, which he joined in 1925.

J. Robert Traver has been named assistant sales manager, Newton-New Haven Co., West Haven, Conn. Mr. Traver will co-ordinate the sales engineering efforts of the company's field repre-

CLARENCE W. ROWSEY

PAUL H. ROESCH
. . . Hamilton Foundry appointments



FRANK J. GENTILE

JOSEPH A. BECKER
. . . Youngstown Foundry changes

OHIO STOVE COMPANY FOUNDRY holds production costs down with SIMPLICITY equipment

At Portsmouth, Ohio, in the modern foundry of the Ohio Stove Co., the SIMPLICITY 4′ x 6′ shakeout and the 30″ x 17′ model VS-12 conveyor (shown here at work) are helping speed operations and reduce unit production costs. First, snap molds are floor dumped; then both castings and sand are scooped and loaded onto the SIMPLICITY shakeout. The castings are then carried on the SIMPLICITY conveyor to the waiting tote boxes. The many plants that are using SIMPLICITY shakeouts are indicative of their foundry-proved superiority. Get complete facts on SIMPLICITY shakeouts, feeders, and conveyors. Write us today.

SALES REPRESENTATIVES IN ALL PARTS OF THE U.S.A.
FOR CANADA: Simplicity Materials Handling Limited, Guelph, Ontario
FOR EXPORT: Brown and Sites, 50 Church Street, New York 7, N. Y.

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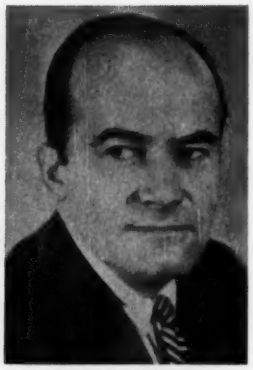
TRADE MARK REGISTERED
ENGINEERING COMPANY • DURAND 7, MICHIGAN

Circle 651 on Page 53

ROBERT A. BARR
. . . B.&W. division v. p.

JAMES TURK
. . . becomes district sales mgr.



WILLIAM BUTLER III
. . . joins Wheelabrator Corp.

RUSSELL E. HARD
. . . AFS chapter chairman

sentatives who serve manufacturers in the territory east of the Mississippi.

Robert A. Barr, general manager of the Refractories Div., Babcock & Wilcox Co., New York, has been elected a vice president. He will replace **James E. Brinckerhoff**, vice president in charge of the division, who has retired after 40 years of service.

Arthur W. Fasold, manager of sales services, has been appointed assistant general sales manager, Hewitt - Robins Inc., Stamford, Conn. He represented the company as field engineer in West Virginia until 1953 when he was transferred to Stamford as assistant manager of commercial research.

Edward A. Miller has been named assistant to the vice president in charge of sales, Williams & Co. Inc., Pittsburgh, metals distributors. Previously he was outside specialty salesman and recently manager of the accessories department.

James Turk has been appointed midwest district sales manager, Cleveland Tramrail Div., Cleveland Crane & Engineering Co., Wickliffe, Ohio, succeeding **William P. Hanks** who has retired after 33 years with the company.

William Butler III, formerly with Lukens Steel Co., Coatesville, Pa., has been appointed administrative assistant to the president, Wheelabrator Corp., Mishawaka, Ind.

Curt W. Gullickson has been named Ohio district manager, Sterling National Industries Inc., Milwaukee, with headquarters in Mansfield. Other newly appointed district managers and their respective offices are **Richard Schindewolf**, eastern New York, northern New Jersey, and northeastern Pennsylvania—Hackensack, N. J.; **Sidney Smith**, southeastern Pennsylvania, southern New Jersey, Maryland, Delaware, Virginia, District of Columbia, and North Carolina—Baltimore; and **Thomas P. McCarthy**, Michigan—Lansing.

Russell E. Hard, elected chairman of the St. Louis Chapter of the American Foundrymen's Society for 1959-60, is secretary and vice president, St. Louis Coke & Foundry Supply Co., St. Louis, the former M. W. Warren Coke Co. Prior to joining the latter company in 1936 he was with Laclede Steel Co. and Spuck Iron & Foundry Co., St. Louis.

Robert E. Schmitz, secretary and controller, Pelton Steel Casting Co., Milwaukee, has been elected to membership in the Controllers Institute of America.

Robert L. Wiseman, formerly sales manager, Microcast Products Div., Austenal Co., New York, has been appointed vice president of sales for the division. Mr. Wiseman joined Austenal 14 years ago.

Charles A. Smith has been elected vice president, and **George Otte**, treasurer, Alter Co., Davenport, Iowa. With the company since 1953, Mr. Smith was formerly

CURT W. GULLICKSON

RICHARD SCHINDEWOLF

SIDNEY SMITH

THOMAS P. McCARTHY

. . . Sterling National district mgrs.

PICKANDS MATHER & CO.

CLEVELAND 14, OHIO

CHICAGO • CINCINNATI • DETROIT • DULUTH
ERIE • GREENSBORO • INDIANAPOLIS • NEW YORK
PITTSBURGH • ST. LOUIS • WASHINGTON

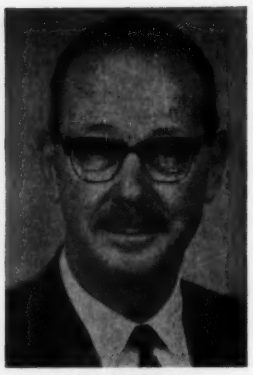
Serving Industry Since 1883

IRON ORE PIG IRON COAL COKE FERROALLOYS LAKE FUELING LAKE SHIPPING

LOUIS J. JACOBS
. . . S. Obermayer Co. v. p.

EDMUND G. GASKELL
. . . AFS chapter chairman

DONALD LEWIS
. . . joins Lester-Phoenix



JOHN C. CLEEVES
. . . joins Pangborn Corp.

auditor and recently buyer. Mr. Otte has been comptroller since he joined Alter Co. in 1957.

Louis J. Jacobs, formerly research director, has been appointed vice president in charge of manufacturing and research for the foundry materials and refractories departments, S. Obermayer Co., Chicago.

Edmund G. Gaskell, chairman of the Southern California Chapter of the American Foundrymen's Society for 1959-60, is plant manager, Ace Foundry Ltd., Huntington Park, Calif. A native of Vancouver, B. C., Canada, he served his apprenticeship at Maple Leaf Iron Works there. In 1925 he went to Los Angeles where he was with Vernon Foundry. He joined Ace Foundry when it was formed in 1928.

Phillip M. Kapp has been named employment manager, Dayton Steel Foundry Co., Dayton, Ohio. He had been personnel director at Brown-Brockmeyer Co., there.

Donald Lewis, formerly with Packard Electric Div., General Motors Corp., Detroit, has been named sales representative in western Pennsylvania and part of Ohio for Lester-Phoenix Inc., Cleveland. He will work with Lester representative **Donald Williams.**

Roy E. Goodwill Jr. has been appointed manager, general products division sales, central region, Allis-Chalmers Mfg. Co., Milwaukee, with headquarters in Cleveland. **William R. Carlyon,** sales representative, has succeeded Mr. Goodwill as manager of general industrial sales in Detroit.

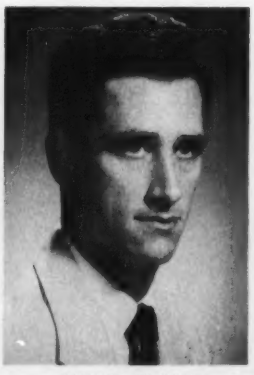
Robert P. Nagel has been named president of the recently formed foundry equipment and engineering company, Hamlin-Nagel Inc., Edwardsville, Ill. Other officers include **Frank B. Hamlin,** executive vice president, **Charles E. Hall,** vice president, and **Linden A. Drda,** secretary-treasurer. The group are also officers of Hamlin Casting Corp. at the same location. Mr. Hamlin organized the company in 1946. Mr. Nagel is vice president, Mr. Hall, vice president-general manager, and Mr. Drda, secretary-treasurer.

John C. Cleeves, recently of Manchester, England, has joined Pangborn Corp., Hagerstown, Md., as development engineer, Dust Control Div.

William J. Fisher, for the past two years manager of the Atlanta sales office, Vacuum Equipment Div., F. J. Stokes Corp., Philadelphia, has been transferred to the metropolitan New York and northern New Jersey area, with headquarters in Union, N. J.

Robert G. Burnside and **Benjamin L. Gidley** have joined Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, Ohio, as field representatives. Mr. Burnside, with headquarters in Troy, N. Y., will cover the New England States and New York. Mr. Gidley will rep-

ROBERT P. NAGEL



CHARLES E. HALL

LINDEN A. DRDA

FRANK B. HAMLIN

. . . Hamlin-Nagel executives

What does the average foundryman say when he rub-tests samples of

CEDAR HEIGHTS *air floated clay?*

He usually exclaims:

SOFT AS VELVET!

FINE AS FLOUR!

LIGHT AS AIR!

The high quality of CEDAR HEIGHTS processed clays is assured by close laboratory control. It's a matter of superior raw materials in the beginning, and careful attention through mining, screening, grinding and packaging afterward. Bonding clays and fire clays for all foundry needs can be delivered in a hurry at very attractive prices. Let us give you the name of your nearest dealer.

Ask your distributor or write to us direct for free samples of our products.

CEDAR HEIGHTS CLAY COMPANY

50 PORTSMOUTH ROAD
OAK HILL, OHIO

Circle 653 on Page 53

WOODWARD IRON COMPANY

Established 1882

We are proud of our long association with the Woodward Iron Company, Woodward, Alabama.

Nationally known Woodward Iron, famed for its uniformity and strength, is the choice of many of America's leading foundries.

Where castings of highest quality are required, Woodward Iron will more than meet your specifications for Malleable; Foundry or High Phosphorous.

We invite your inquiries. We believe that you will like the outstanding service that the "Woodward-H-W" team will give you.

There is a Hickman-Williams office as near as your phone.

70th Year of Service to the Foundries of America

Established 1890

Hickman, Williams & Co.

CHICAGO • DETROIT • CINCINNATI • ST. LOUIS • NEW YORK
CLEVELAND • PHILADELPHIA • PITTSBURGH • INDIANAPOLIS
Established 1890

resent the company in the Philadelphia area.

Cameron Sevier Jr. has joined Basic Inc., Cleveland, as sales-service engineer in the Atlantic district

CAMERON SEVIER JR.
. . . joins Basic Inc.

office recently opened in King of Prussia, Pa. **Thomas P. Stanton** is district manager there.

William E. Boyd, chairman of the Central Indiana Chapter of the American Foundrymen's Society for 1959-60, is Indianapolis district sales manager, Mexico Refractories

WILLIAM E. BOYD
. . . AFS chapter chairman

Co., Mexico, Mo., Div. of Kaiser Refractories & Chemicals, Oakland, Calif. A graduate of University of Missouri, he joined Mexico Refractories ten years ago.

Harold M. Krueger has been appointed general manager, and **Marvin M. Oswalt**, his assistant, Christensen & Olsen Foundry Co., Chicago. Mr. Krueger will be in charge of plant operation, sales, personnel, and expansion. Mr. Oswalt will supervise production and

SAVE $36.00 a ton on cast iron chips

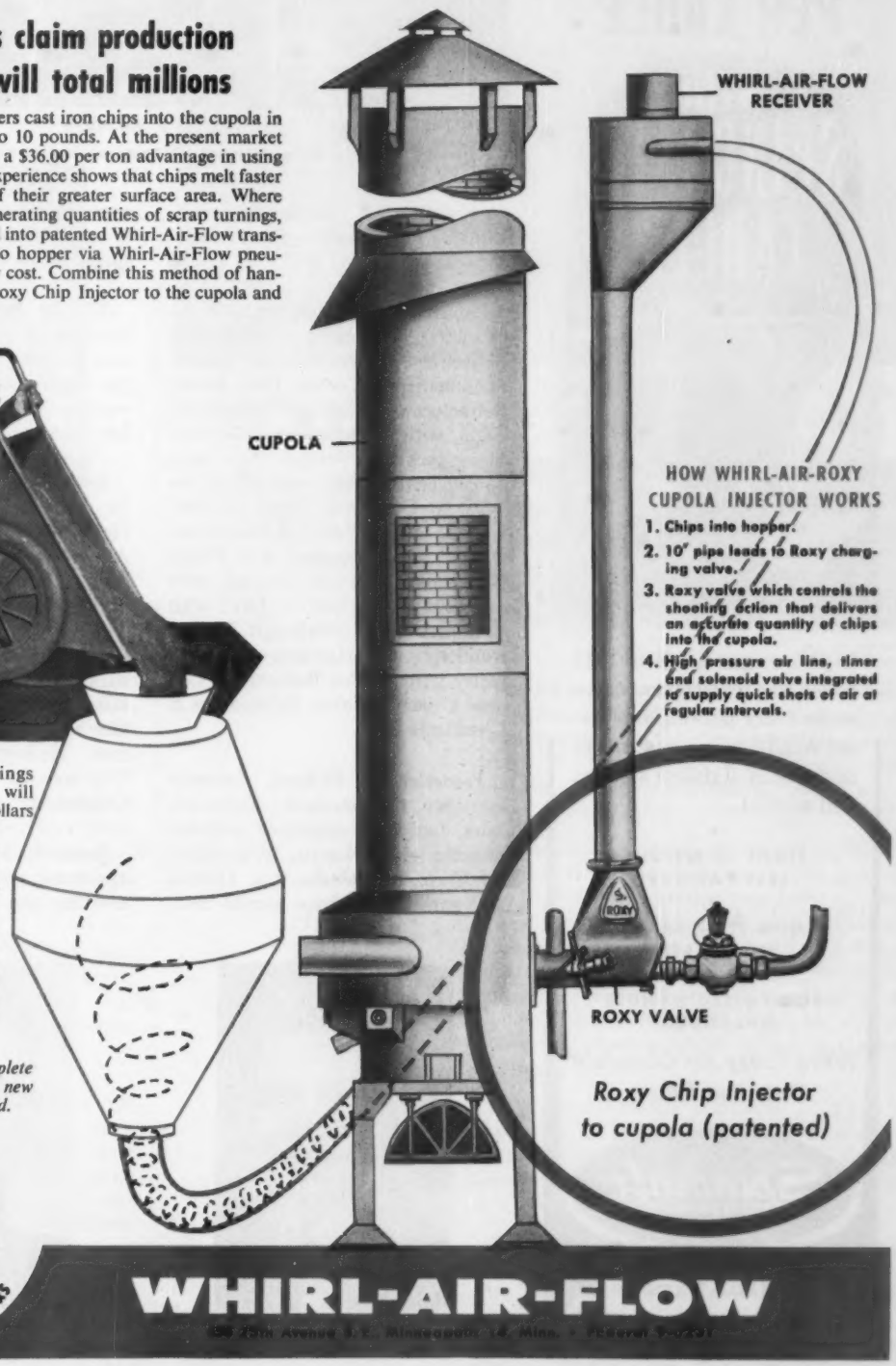
New Whirl-Air-Roxy method delivers chips from Machine Shop to Cupola *(patented)*

Foundries claim production savings will total millions

New Roxy valve delivers cast iron chips into the cupola in measured shots of 7 to 10 pounds. At the present market value of scrap there is a $36.00 per ton advantage in using chips. Also, foundry experience shows that chips melt faster than scrap because of their greater surface area. Where machine shops are generating quantities of scrap turnings, they can be discharged into patented Whirl-Air-Flow transporter and delivered to hopper via Whirl-Air-Flow pneumatic conveyor at low cost. Combine this method of handling chips with the Roxy Chip Injector to the cupola and

you will achieve savings that foundrymen say will amount to a million dollars in very few years of operation. The Whirl-Air-Roxy method is easily applied to any size foundry; small, medium or large. Initial cost is low and savings will pay for installations in a period of a few months. We invite your exploratory inquiry.

Write or wire for complete information on the new Whirl-Air-Roxy method.


WHIRL-AIR-FLOW RECEIVER
CUPOLA
HOW WHIRL-AIR-ROXY CUPOLA INJECTOR WORKS
1. Chips into hopper.
2. 10" pipe leads to Roxy charging valve.
3. Roxy valve which controls the shooting action that delivers an accurate quantity of chips into the cupola.
4. High pressure air line, timer and solenoid valve integrated to supply quick shots of air at regular intervals.
ROXY
ROXY VALVE
Roxy Chip Injector to cupola (patented)

WHIRL AIR FLOW PNEUMATIC CONVEYORS

WHIRL-AIR-FLOW

[redacted]

POUR EASIER,
POUR FASTER,
MORE POURS
PER LADLE
with
SPINCRAFT
LADLES

Light, rugged, Spincraft ladles save replacement costs, make every pouring job easier! Available in a vast range of sizes, in stainless steel as well as mild.

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LIGHT IN WEIGHT
LESS FATIGUE!
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NON-SPILL SHAPE
NO WASTE!
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EQUIPOISED HANDLE
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Write Today for Complete Data and Prices.

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SKILL WILL DO IT

Division 2-0730
4124 WEST STATE STREET
MILWAUKEE 8, WISCONSIN

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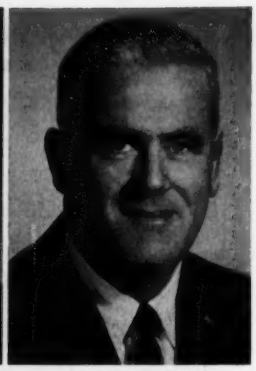
L. A. HARRISON

HALFRED F. RANDOLPH



JACK T. PUTNAM

. . . Kaiser Refractories & Chemicals Div. appointments

quality control. They were formerly with National Bearing Div., American Brake Shoe Co., St. Louis.

Halfred F. Randolph has been appointed general sales manager and **Robert L. Petersen,** assistant general sales manager, Central Div., Kaiser Refractories & Chemicals, Oakland, Calif., with headquarters in Mexico, Mo. **Jack T. Putnam** has been named general sales manager of the Western Div. with offices in Oakland. **L. A. Harrison** has been made general sales manager, and **Philip A. Gaebe,** assistant general sales manager of the Eastern Div., with headquarters in Pittsburgh. Messrs. Randolph and Harrison were formerly with Mexico Refractories Co., now a part of Kaiser Refractories & Chemicals Div.

Frederick J. Pichard, formerly manager of standard equipment sales, has been appointed assistant director of marketing, Wheelabrator Corp., Mishawaka, Ind. **Donald A. Swardson** has been named manager of abrasive sales. He has been in the Mishawaka office as abrasive specialist for two years.

W. E. Busker, vice president-treasurer, Campbell Wyant & Cannon Foundry Co., Muskegon, Mich., has been elected president of the western Michigan control, Controllers Institute of America.

Robert F. Fox, regional manager for the metropolitan New York-New Jersey area, Eutectic Welding Alloys Corp., Flushing, N. Y., has been named national sales manager of the company.

Lee Grunkemeyer has been named sales representative in southwestern Ohio and Kentucky, Steel City Testing Machines Inc., Detroit. He formerly handled the Steel City account with Hare Equipment, Cincinnati.

James R. McAllister Jr. has been appointed an area sales representative for the resins and chemicals

FREDERICK J. PICHARD

DONALD A. SWARDSON

. . . Wheelabrator Corp. promotions

department, Borden Chemical Co., New York. He will cover Virginia with headquarters in Martinsville.

Peter A. Spuhler has been appointed sales engineer in the Salem-Warren-Youngstown, Ohio area, Hunt Valve Co., Salem, Ohio.

R. G. Berlinghof, until recently with Louden Machinery Co., Fairfield, Iowa, has been appointed sales representative in the Baltimore district, Spanmaster Crane Div., Jervis B. Webb Co., Detroit.

R. JAMES SWARTOUT, elected president, Belle City Malleable Iron Co., and Racine Steel Castings Co., Racine, Wis., as reported in November

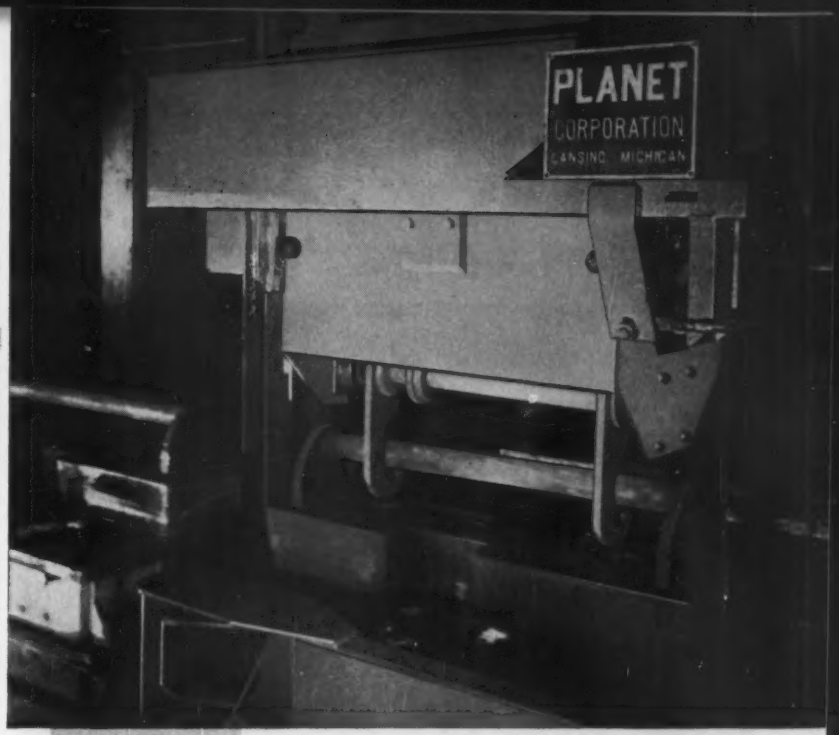
Karl E. Krogstad has been appointed a field engineer in the Philadelphia office, Norton Co., Worcester, Mass. He joined the company last year.

Donald R. Smith has been named plant manager, Ironton Fire Brick Co., Ironton, Ohio. He was formerly manager of the special products division.

Conrad G. Meyer Jr. has been named assistant sales manager, Lakeside Malleable Castings Co., Racine, Wis. He joined the company in 1953.

John G. McLain has been appointed western manager of foundry and mill machinery sales, Blaw-Knox Co., Pittsburgh. **Gilbert C. Berquist,** roll sales engineer, has been assigned to the West Coast. Their headquarters will be at the west coast office in Millbrae, Calif. Mr. McLain has been engaged in sales of rolls, rolling mill machinery, and steel plant equipment. Mr. Berquist

Circle 657 on Page 53→



Weight-Shifter, at International Harvester's Indianapolis Truck Engine Works, automatically places weight on mold.

PV
FINDS A NEW WAY TO DO AN OLD JOB...

PLANET WEIGHT-SHIFTER* SPEEDS PRODUCTION, SAVES LABOR BY ELIMINATING HAND CLAMPING

*Patent Pending

Planet Corporation's Weight-Shifter eliminates clamping or manual handling of weights by gently placing weights on top of molds and later removing them . . . this completely automatic operation, capable of accommodating 400 molds per hour, saves time and labor.

As a mold approaches the Weight-Shifter it trips a switch which activates the loader mechanism. The loader hook carriage engages a weight, elevates it, swings it out, and gently and accurately places it on a passing mold. After pouring, the mold passes by the rear end of the Weight-Shifter where the weight is retrieved by a similar operation. The retrieved weight is set on a conveyor within the machine to be carried to the loading end ready for reuse.

The Weight-Shifter is flexible . . .it can be installed on an old line as well as on a new line. Weight discharge height, weight size, vertical dimension, and speed of operation can be adjusted to fit any foundry's operation.

This new way to do an old, manual job is a product of "PV" . . . *Planet Versatility* . . . the quality that has made Planet Corporation known throughout the foundry industry as an organization with solutions to production, materials handling and automation problems. Write or phone for more information about the Weight-Shifter today.

PLANET CORPORATION

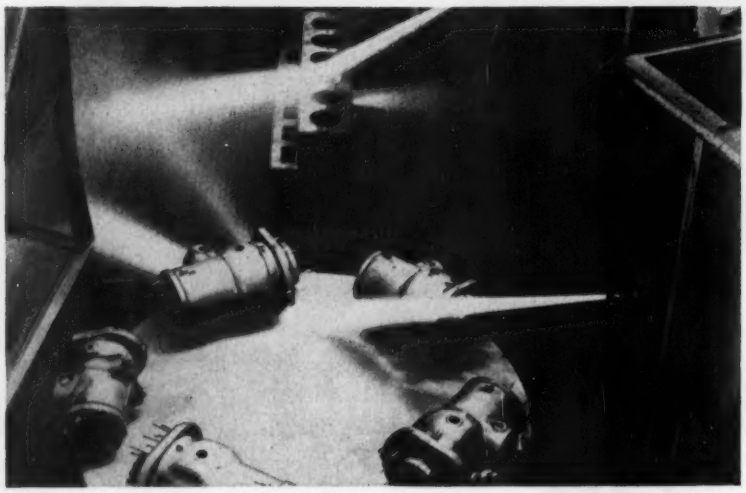
1818 SUNSET AVENUE
LANSING, MICHIGAN

• Engineered Handling Equipment
• Automation Equipment
• Mill & Foundry Handling Equipment

95

HYDRO-BLAST

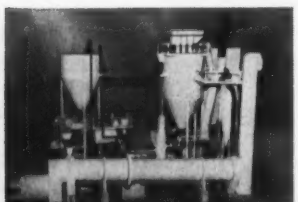
works wonders with sand!



Knocks out cores, cleans castings in a fraction of usual man hours

With Hydro-Blast Equipment, one man can clean the largest, most complicated castings in a fraction of the usual time. Heavy, intricate cores are knocked out—all casting surfaces are de-scaled, left exceptionally clean. The process is completely dustless. Hydro-Blast installations pay for themselves quickly through better, faster cleaning, more healthful working conditions.

Recent Hydro-Blast installations: General Electric Co., Schenectady, N.Y. . . . Gould Pump Co., Seneca Falls, N.Y. . . . Bethlehem Steel Co., Sparrows Point, Md.

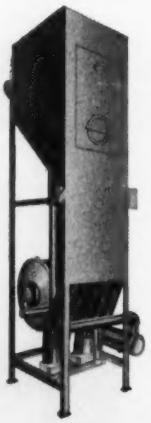


Hydro-Blast Wet Sand Reclamation Units

Cleaner, good-as-new core and molding sand, with fully controlled classification. *Recent installations: General Electric Co., Schenectady, N.Y. . . . American Radiator & Standard Sanitary Co., Buffalo, N.Y.*

Hydro-Blast Dry Sand Reclamation Units

Recent installations: Farrell Birmingham Co., Ansonia, Conn. . . . Adirondak Steel Foundries, Watervliet, N.Y. . . . Amsco, Chicago Hts., Ill. . . . Midcontinent Steel Castings Co., Shreveport, La.



A-M

HYDRO-BLAST DIVISION
GUARDITE
WHEELING, ILLINOIS
DIVISION of AMERICAN-MARIETTA COMPANY

has been a sales engineer in the company's Aetna-Standard Div., Ellwood City, Pa.

William G. Hodson has been appointed Indiana regional manager, Mid-West Abrasive Co., Owosso, Mich. He has represented the company in Indiana for the last eight years.

William Pitts, chairman of the Tri-State Chapter of the American Foundrymen's Society for 1959-60, since 1950 has been standards supervisor, Oklahoma Steel Castings

WILLIAM PITTS
. . . heads AFS Chapter

Co., Div. of American Steel & Pump Corp., Tulsa, Okla. He joined the company in 1942 as an inspector and was transferred to the standards department in 1946. Mr. Pitts also supervises the standards departments of East Texas Steel Castings Co., Longview, Tex., and Webb Wheel Div., Siloam Springs, Ark., company subsidiaries.

T. L. Dineen has been named manager, general industrial sales, Cleveland district of the Industries Group, Allis-Chalmers Mfg. Co., Milwaukee. **Roger W. Cavanaugh,** former Cleveland district representative, succeeds Mr. Dineen as manager, metals industry sales. **W. F. Bueche** has been appointed manager of utility sales, and **R. M. Morrow,** supervisor of original equipment manufacturers and distributor sales. Messrs. Bueche and Morrow formerly were sales representatives in the Cleveland district.

Thurman J. Brown was honored at a party recently upon his retirement after 32 years as sales repre-

sentative with Federal Foundry Supply Div., Archer-Daniels-Midland Co., Cleveland. With a total of over 50 years in the foundry industry, previously he was a molder, foreman, and superintendent in Ohio, Michigan, and Indiana foundries.

James W. McEwan has been named assistant sales manager, Elwell-Parker Electric Co., Cleveland. For the past 13 years he has sold

JAMES W. McEWAN
. . . joins Elwell-Parker

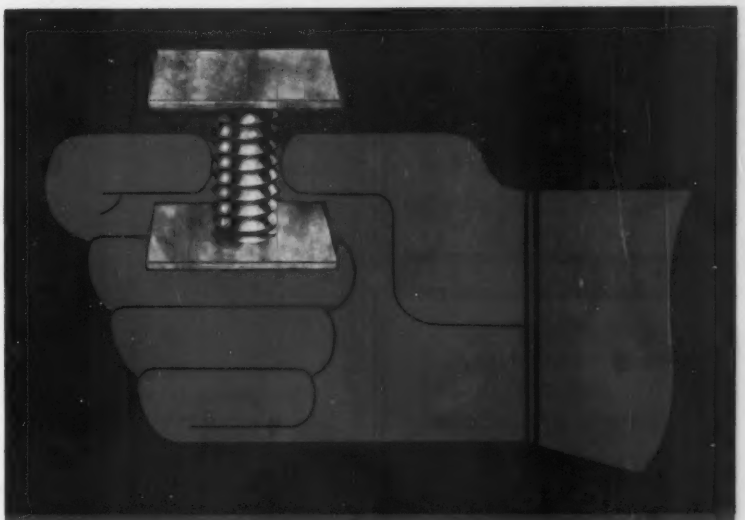
the company's trucks in the east for Parkell Engineering Co., New York, a distributor.

Charles R. Funk has been named chief metallurgist of the eastern division, Colorado Fuel & Iron Corp., New York, with headquarters at the Claymont, Del., plant. Until recently he was with Alco Products Inc., Latrobe, Pa.

Lawrence J. Andres, elected president of the Wisconsin Chapter of

LAWRENCE J. ANDRES
. . . heads Wisconsin Chapter

the American Foundrymen's Society for 1959-60, is president and general manager, Lawran Foundry Co.,



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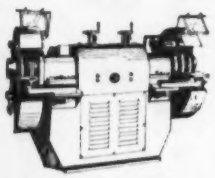

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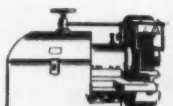

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GEORGE W. ANSELMAN
. . . foundry coke sales

FRANKLYN J. MILLHOUSE
. . . Pacific Coast sales mgr.

Milwaukee. A former president of the Wisconsin Chapter of the Non-Ferrous Founders' Society, he is presently a director and chairman of the Cost Committee of the national organization.

George W. Anselman, Anselman Foundry Services, St. Charles, Ill., has been appointed representative in the Chicago area for Alabama By-Products Corp., Birmingham, in sales of foundry coke. Prior to establishing his own company he was with Whirl-Air-Flow Corp., Chicago and Minneapolis. Mr. Anselman is active in committee work of the American Foundrymen's Society.

Lloyd A. Unger has been appointed financial administrative assistant, Superior Steel & Malleable Castings Co., Benton Harbor, Mich.

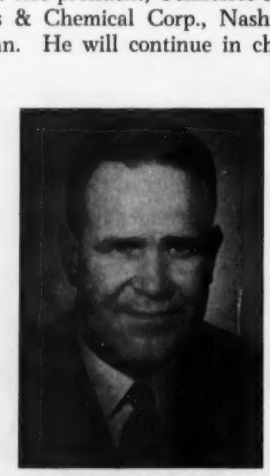
Howard B. Myers has been elected a vice president, Tennessee Products & Chemical Corp., Nashville, Tenn. He will continue in charge of metallurgical sales, which he has headed since 1958.

Franklyn J. Millhouse has been made Pacific Coast sales manager, Electrode Div., Great Lakes Carbon Corp., New York, with headquarters in San Francisco. He was a sales representative in the division's Detroit office.

William M. Grimes, formerly vice president, has been elected president, Gartland Foundry Co., Terre Haute, Ind. He continues as general manager.

Joseph G. Solari has been named vice president in charge of carbon division sales, Great Lakes Carbon Corp., New York. He was vice president, Sterling Precision Corp., Port Washington, N. Y., and Cambridge, Mass.

Carleton D. Cole has been appointed Detroit regional manager, Mid-West Abrasive Co., Owosso, Mich.



HOWARD B. MYERS
. . . Tennessee Products v. p.

CARLETON D. COLE
. . . becomes regional mgr.

ORDNANCE ASSOCIATION SECTION

Discusses Foundry Developments

● THE CASTING SECTION, Production Techniques Division, American Ordnance Association, held a two-day meeting at Watertown Arsenal, Watertown, Mass., Nov. 19-20. The affair was well attended by AOA members in the foundry industry and by government representatives.

The Casting Committee of AOA was organized last year to bring to government agencies the developments in the foundry industry (FOUNDRY, June 1959, p. 173). The meeting at the arsenal was a part of that program. It also offered an opportunity for industry representatives to learn of the work on cast metals being pursued at the government facility.

The first morning was devoted to discussions by government representatives. John Zotos of the arsenal discussed "Theoretical Considerations in Vacuum Melting of Steel." P. S. Schaffer of the arsenal talked on "Vacuum Melting and Casting High-Strength Steel." Hyman Rosenthal, Frankford Arsenal, Philadelphia, spoke on "Degassing and Other Parameters Affecting the Quality of Aluminum Castings."

The second section of the morning program considered "Techniques of Producing High-Strength Cast Metals." K. D. Holmes, Watertown Arsenal, discussed "Mechanical Properties of Steels Containing Low Sulfur and Phosphorus Content." P. J. Ahearn of the arsenal spoke on "Metallurgical Size Factor in High-Strength Steel Castings," and G. D. Chandley of the arsenal considered "High-Strength Quality Aluminum Castings."

In the afternoon those in attendance toured the arsenal and saw a demonstration of vacuum melting and degassing. This was followed by the presentation of a film, "Toward More Effective Steel," produced by Army Ordnance.

At the dinner, Hans J. Heine, technical director, Malleable Founders' Society, emphasized the need for greater attention to foundry research in this country.

Industry representatives considered "Today's Casting Techniques of Core and Mold Production" at the morning session on Nov. 20. The following talks were presented: "Green Sand and Sodium Silicates," by B. C. Yearley, National Malleable & Steel Castings Co., Cleveland; "Resin Shell Mold and Core," by Larson E. Wile, Lynchburg Foundry Co., Lynchburg, Va.; "Ceramic Shell Molds," by Leo Carr, Precision Metalsmiths Inc., Cleveland; "Pressure Pouring of Ordnance Castings in Graphite Molds," by E. J. Zickefoose, Griffin Wheel Co., Chicago.

The afternoon program included the following: "Advanced Design Techniques," by J. M. Dugan, Ohio Steel Foundry Co., Springfield, Ohio; "Advanced Inspection Techniques," by Frank B. Rote, Albion Malleable Iron Co., Albion, Mich., and a summary of the meeting by Collins L. Carter of Albion, deputy chairman of the Castings Committee.

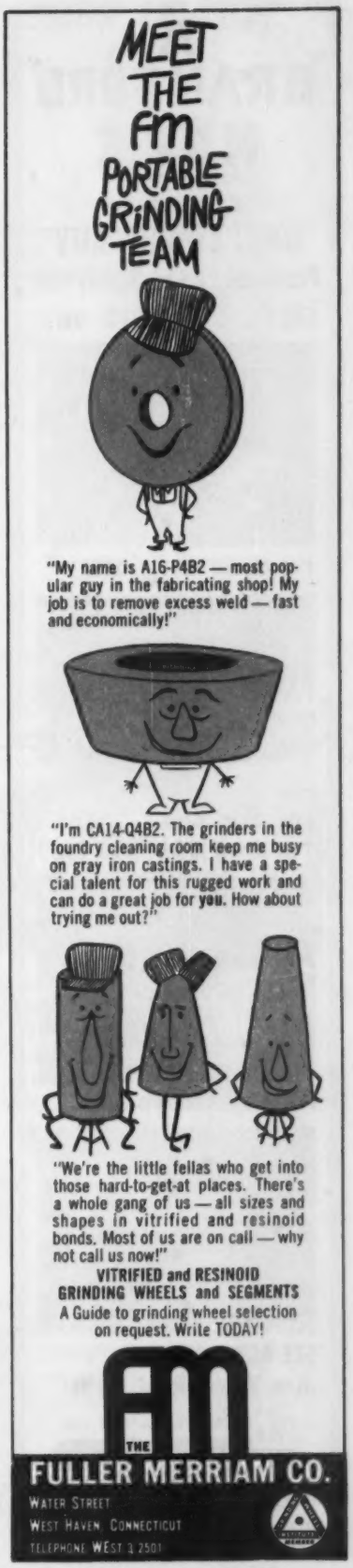
Stowell C. Wasson, National Malleable & Steel Castings Co., Cleveland, the chairman of the Castings Committee, and W. M. Dalton, Dalton Foundries Inc., Warsaw, Ind., secretary of the committee, presided.

The group was welcomed to the arsenal by Maj. Gen. A. Schomburg, deputy chief of Ordnance, Washington. Maj. Gen. E. P. Mechling (Ret.), staff director, Technical Operations, AOA, Washington, praised the exceptional work of the Castings Committee since its organization.

Training Films Deal with Communication for Safety

The National Safety Council has released four training films entitled "Communication for Safety." They discuss a solution to the problem of communication, using everyday situations between supervisor and worker and an effective combination of photography and animation.

The films are available individually or in series, and come in two sizes—16-mm sound-motion picture, and 35-mm sound-slide film. Further information can be obtained from the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.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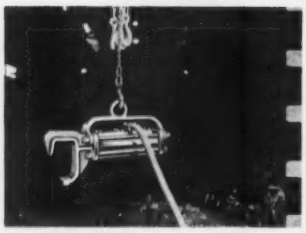
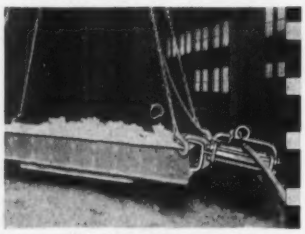
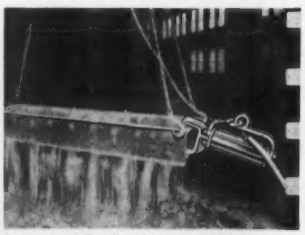


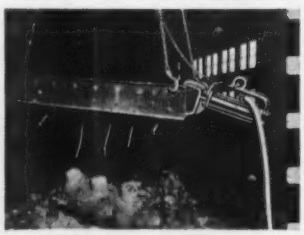
I'm Movin' in . . . SEE!



***I'm takin' over . . . SEE You Can't Beat* THIS RAP!**



***It's a Shakedown* SEE!**



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Circle 662 on Page 53

Obituary

Garnet P. Phillips, 57, foundry research consultant, manufacturing research, International Harvester Co., Chicago, died Nov. 29. He received a master of science degree from Carnegie Institute of Technology, and in 1935 joined the Harvester company as chief metallurgist of automotive foundries. In 1946 he was transferred to manufacturing research, and from 1949 to 1958 was general supervisor of foundry research. A former chairman of the Chicago Chapter of the American Foundrymen's Society, Mr. Phillips recently completed a three-year term as a national director.

GARNET P. PHILLIPS

Herbert J. McCaslin, 38, retired patternmaker, author, and teacher, died recently. He worked as a journeyman patternmaker in the Philadelphia Ship Yard, and from 1900 to 1910 was foreman patternmaker, Wellman Seaver Morgan Co., Cleveland. He became an instructor in a Cleveland technical institute and in 1913 went to Jersey City, N. J., where he taught at Dickinson High School. He retired in 1947. The author of books on American shop practice and wood patternmaking, Mr. McCaslin was a contributor to FOUNDRY in his early career.

A. J. Heysel, eastern manager, E. J. Woodison Co., Detroit, with headquarters in Buffalo, and chairman of the Western New York Chapter of the AFS for 1959-60,

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died Nov. 12. He worked in the chemical laboratories of Pratt & Letchworth Co., Buffalo, and later was superintendent, Lockport Fittings Co., Lockport, N. Y. After a period in Australia, where he installed equipment, Mr. Heysel was made New York and Pennsylvania representative of the Woodison Co., and manager of the Buffalo branch.

Edwin T. Doddridge, 86, former vice president, William Nicholls Co., Richmond Hill, Long Island, N. Y., died Nov. 21 in Rocky River, Ohio. He was head of the pattern department, Ferro Foundry & Machine Co., Cleveland, until 1909, when he joined Osborn Mfg. Co., there. He became senior sales engineer and later research and development engineer for Osborn during over 25 years of service with the company. He joined Nicholls in 1937.

John M. Weidephul, 72, for 20 years foundry superintendent, Wehr Steel Co., Milwaukee, died Nov. 22. In 1950 he joined Crucible Steel Casting Co., Milwaukee. Although semi-retired, for the last seven years he operated Falls Aluminum & Brass Foundry Co., there.

Frederick B. Clarke, 70, for the last 16 years New England manager, Whitehead Bros. Co., New York, died suddenly Nov. 20. He joined the company 41 years ago as a salesman, and was named a director of the company in 1944.

Patrick J. Gibbons, 69, former executive vice president, Vanadium Corp. of America, New York, died Nov. 28. With the company 42 years, following his retirement in 1952 he continued as a consultant.

C. R. Conklin, 63, general sales manager, Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, Ohio, died Nov. 3.

Herbert W. Richter, 58, foundry supervisor, Chain Belt Co., Milwaukee, died Oct. 10. He had been with the company for 30 years.

William S. Haney, former vice president of sales, Penn Steel Castings Co., Chester, Pa., died Oct. 6.

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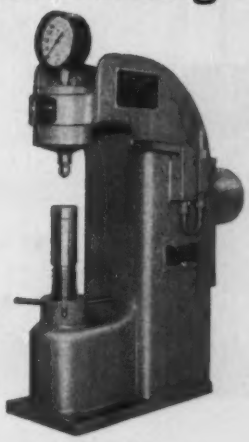

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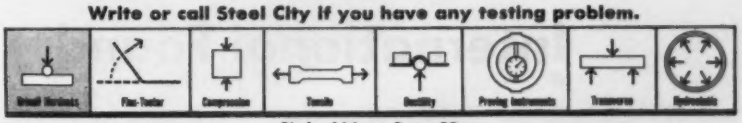

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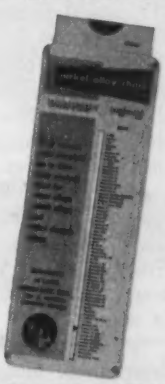

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The Institute of Iron and Steel, Madrid, site of the International Foundry Congress

TECHNICAL REPORTS..

International Foundry Congress

Last month, the first installment of this report described events at the International Foundry Congress and presented some resumes of papers delivered at technical sessions. Resumes are concluded here

By M. M. HALLETT
Managing Director
Chamberlin & Hill Ltd., Walsall, England
European Editor, Foundry

● AT THE recent International Foundry Congress in Madrid, R. Loison, L. Soubrier, and M. Decrop (France) presented a useful report on an extensive investigation into the effect of coke quality and size on cupola performance. Although the results were not unexpected, they yielded a good deal of practical information.

Many different grades of screened coke and one grade screened to different sizes were used, and runs of either three to four hours or ten hours were made in a cupola 27 in. in diam.

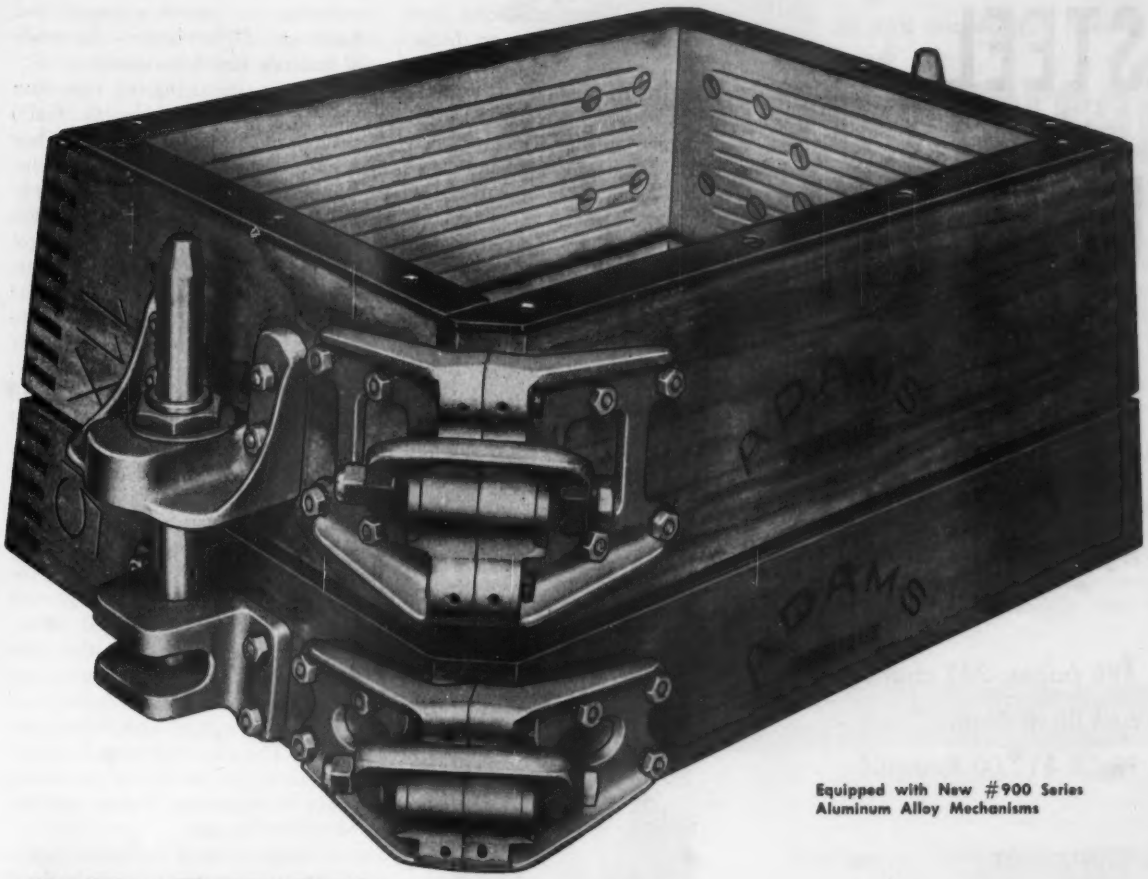
All normal coke properties were determined, including reactivity at 1830 and 2550° F, the latter being found to be clearly related to coke porosity. As coke size increased from about 2 to 4 in., metal temperature increased and melting rate decreased. Coke varying widely in size was less satisfactory than screened coke. Metal temperature fell as reactivity increased, but rose with increasing coke strength.

D. Escorsa Civis (Spain) pointed out that casting yield is a most important factor in determining cost. These costs can be calculated and plotted, and other costs can be read off easily from the resulting graphs. Examples were quoted of the use to which such calculations can be put.

International Dictionary — The steady progress being made toward publication of the International Dictionary produced a paper by P. Huberson, secretary of the French committee co-ordinating the work. He illustrated several cases of difficulty in translating French words into English and discussed the principles on which the dictionary should be based. Arrangement of the dictionary, with 2500 words in eight languages, was described.

Accompanying the paper was an interesting UNESCO table showing the linguistic abilities of scientists in different countries. In the USA about 10 per cent of scientists can read German and about 5 per cent French. The proportions able to read foreign languages are somewhat higher in England, but lower in France. Germany is better than England, but of the large countries Russia is far the best; about half of Russian scientists can read English, French, or German. Smaller countries such as Holland and Norway are recognized to be better linguists, but the most phenomenal result is shown by Denmark. All Danish scientists can read English, French, and German.

Vacuum Treatment — O. Necas and R. Kamensky (Czechoslovakia)



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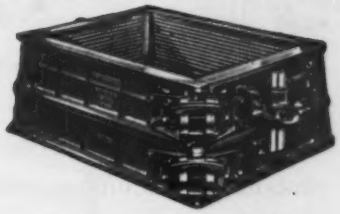

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reported on vacuum treatment work on cast iron melted in an induction furnace and cast either in air or in an ingot mold about 4 in. in diam and 18 in. long which previously had been placed in an evacuated chamber. The iron varied from 3.2 to 3.75 per cent carbon with about 2 per cent Si, 1 per cent Mn, 0.04 per cent S, and either 0.08 or 0.25 per cent P.

Vacuum casting reduced sulfur by about 10 per cent, hydrogen and nitrogen by about 40 per cent, and oxygen by about 20 per cent. The most marked changes were in the microstructure. The vacuum-cast metal was much more ferritic than air-cast iron, with much finer graphite flakes and a corresponding reduction in tensile strength and hardness. Differences in the mode of fracture also were noted.

Vacuum degassing of cast iron also was considered by C. Gallo and G. d'Alessandro (Italy). They described the various systems in induction and arc furnaces and subsequent treatments such as vacuum stream degassing, vacuum ingot casting, and vacuum ladle degassing. As in the Czech studies, the vacuum-treated irons were more ferritic and contained finer graphite than untreated iron. Both nitrogen and hydrogen were found to retard graphitization during annealing of blackheart malleable iron, but oxygen had little effect. Degassed iron therefore anneals much more rapidly. Treated iron naturally is less porous.

Nonferrous Test Bars—In the nonferrous section, Z. Gorny and A. Fijal (Poland) described an extensive statistical investigation into the merits of separately cast test bars produced by a variety of American, English, and Polish patterns. The alloys employed included leaded gun metal and brass, two types of aluminum bronze, and two of silicon bronze.

Criteria studied included reproducibility, sensitivity, and the level of properties as well as of defects, together with less important factors such as consumption of material and time of production. In addition to rather complicated statistical conclusions, the paper also provides data on the effect of pouring temperature on mechanical properties of the various alloys.

Al-Mg Alloys—L. J. G. van Ewijk (Holland), who at previous international conferences has presented a series of papers on the heat treatment and properties of aluminum magnesium alloys, continued the series with a study of microstructural changes during artificial aging. He showed 30 typical structures. Contrary to most previous investigators, who found that beta precipitation occurs first at grain boundaries and later in the interior of the grains, precipitation in the present work always started within the grains. It was not influenced obviously by other microconstituents or by purity. No precipitation occurred in five years at room temperature.

Tin Bronze — M. Sugiyama

THE AUTHOR

Michael M. Hallett, author of this report on the International Foundry Congress, for the last five years has been managing director of Chamberlin & Hill Ltd., gray iron founders of Walsall and Lichfield, England. Previously he spent nearly 12 years as a research metallurgist for Mond Nickel Co. Ltd. in Birmingham and a like period with the Sheepbridge Engineering group as director of research and director of sales.

MICHAEL M. HALLETT

Mr. Hallett serves on many committees of the Institute of British Foundrymen, is chairman of its Technical Council and a member of its General Council. He is also vice chairman of the council of the British Cast Iron Research Association as well as a member of several committees, a member of the executive committees of the Council of Ironfoundry Associations and of the Joint Iron Council, and honorary treasurer and a member of the board of governors of the National Foundry College.

Mr. Hallett has represented FOUNDRY as European editor the last two years.

(Japan) pointed out that tin bronze, because of its long solidification range, is likely to show dispersed porosity in castings with equiaxed crystal grains and centerline shrinkage in columnar crystal regions. Experimental plate castings cast horizontally with a large feeder at one end were sounder and stronger in the regions remote from the feeder. The sound zone increased in extent in proportion to increasing thickness of plate. Horizontal pouring was better than vertical pouring. Degassing was desirable.

As the tin content was reduced, thus reducing the solidification range, the difference in properties between the various regions of a casting also was reduced. Correspondingly, brass and aluminum bronze with short freezing ranges were easier to feed effectively.

Niobium—T. Hurlen (Norway) reported an investigation on the oxidation of niobium (columbium) which was carried out competently and in great detail. The oxidation was studied at temperatures from 300 to 1830° F and at oxygen pressures from 1 atmosphere down to 1/100 mm. The mechanism of oxidation was found to be complex, with evidence of two suboxides in addition to the three known oxides. Whisker formation, a subject of great interest in other metals, was observed at the higher temperatures.

Tin Bronze—F. Joanxich Ayma (Spain) cited an example of an 85/15 tin bronze gear which had failed in service and studied the segregation of the alpha-delta eutectoid. Bronzes with 10, 15 and 20 per cent tin were employed, and the effect of time and reheating at 1200° F studied. The effects of chemical composition and of production conditions and directional solidification were considered. Particular attention was drawn to the effect of furnace atmosphere; segregation was much less marked when melting was carried out in an oxidizing, instead of reducing atmosphere.

High-Strength Alloys—A. Krupkowski and W. Kajoch (Poland) endeavored to develop a new series of high-strength alloys as a compromise between the low cost of zinc-base alloys and the superior properties of copper-base alloys;

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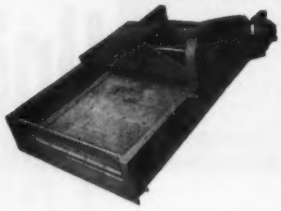

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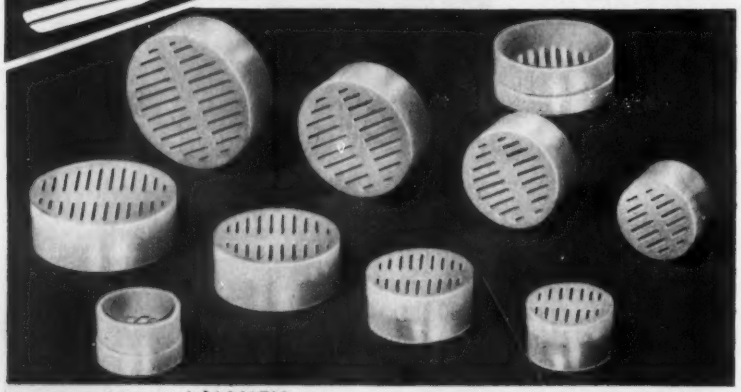

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Circle 671 on Page 53

they concentrated on alloys containing the hexagonal, closely packed epsilon phase, usually with about 15 per cent copper and 15 to 25 per cent manganese in a zinc base, but noted the earlier American work of Ramsey and Werley in this field.

Typical alloys had tensile strength of about 85,000 psi, elongation of 9 to 18 per cent and Brinell hardness of 165 as cast. Wear resistance in unlubricated conditions appears to be better than that of brass, and the alloy was resistant to corrosion by water and weak salt solutions at room temperature, but not to weak acids.

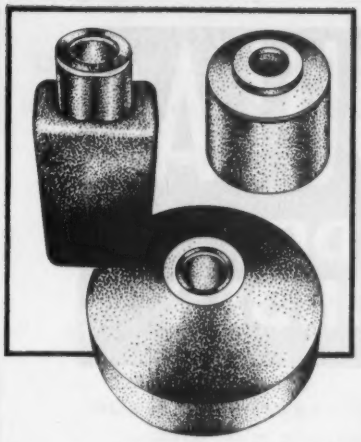
Carbon was the most harmful impurity; 0.1 per cent lowered the elongation from 15 to 3 per cent, and a similar reduction was effected by 0.5 per cent silicon. Iron was less harmful. Foundry properties are similar to those of brass, but with a lower susceptibility to hot tearing.

Nodular Iron—The last session was devoted to papers on nodular iron. I. Aoki (Japan) discussed defects experienced in the production of pig iron sufficiently low in residual elements to be suitable for making nodular iron. The most harmful elements were found to be bismuth, lead, and antimony, followed by arsenic, tin, and aluminum, in order. The critical amounts of most of these elements were lowered drastically and progressively as titanium content rose to 0.1 per cent.

F. Rodriguez Yufera and J. Orland (Spain) described production of nodular iron using a copper-magnesium (14 per cent Mg) addition followed by ferrosilicon (45 per cent Si). Tensile strength values of about 65,000 psi with 5 to 10 per cent elongation were achieved. The general conclusion is that the copper alloy gives very useful results, even if they are not as good as those given by nickel-magnesium alloys.

A particularly successful industrial application was for rolls. Data were recorded for rolls ranging from about 12 to 45 in. in diam and in compositions with total carbon contents ranging from 2 to 3.6 per cent. Measurements were made of fatigue strength, impact strength and Young's modulus.

D. Pohl, E. Roos, and E. Scheil



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Circle 673 on Page 53

(Germany) presented a paper on the theory of the effect of magnesium in producing nodular graphite. Magnesium was believed to be present either in a relatively inert condition combined as a chemical compound or in a free state. In the latter condition, it vaporizes more readily than when combined. An analytical technique was developed in which a cast iron sample was heated in a closed system to about 2370° F and the magnesium vapor condensed and weighed.

The free magnesium content so determined was found to raise the surface tension of cast iron to a sharp maximum at about 0.05 per cent magnesium, whereas sulfur rapidly reduced surface tension. Clear relationships were found between magnesium content, surface tension, and characteristics of the spheroids of graphite. It was concluded that magnesium not only functioned so as to neutralize harmful trace elements, but also in its free form played a direct part in nodule formation.

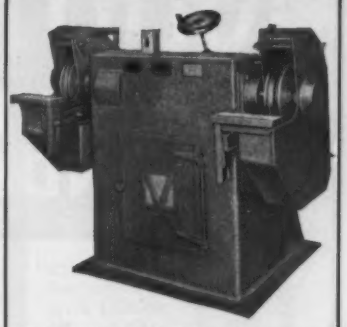
Cast Iron Pipe—H. A. Nipper (Germany) dealt with the characteristics of centrifugally cast pipe in gray and nodular irons. He first described their solidification processes as they occur in static sand and metal molds.

Numerous illustrations of typical microstructures and of typical defects were shown. These were related to the many factors influencing solidification.

P. Rys (Czechoslovakia) reported a detailed study of graphitization during annealing of spheroidal graphite cast iron as influenced by the earlier heat treatment. The work was carried out on an iron with 3.1 per cent total carbon and 3.1 per cent silicon with a residual magnesium content of 0.078 per cent. Graphitization was followed by a dilatometric method.

The main conclusion was that graphitization was greatly accelerated by previous treatments, which left the material in a condition differing widely from equilibrium or containing many discontinuities or dislocations. Conversely, if it was desired to delay graphitization, the material should be put into a relatively stable condition such as that resulting from austempering (in this case, treatment at 750° F).

MARSCHKE



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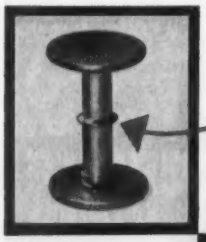

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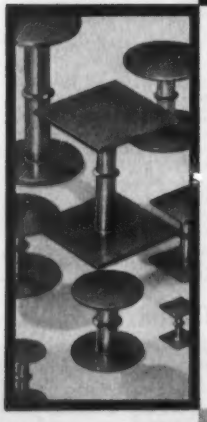

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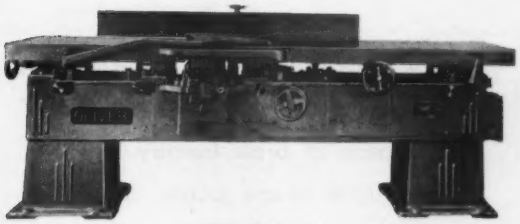

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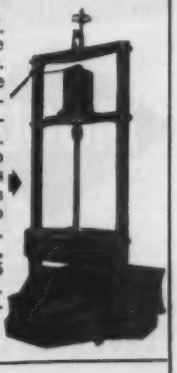

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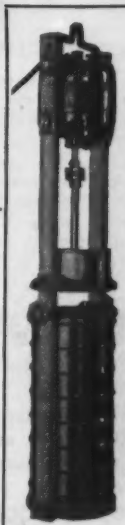

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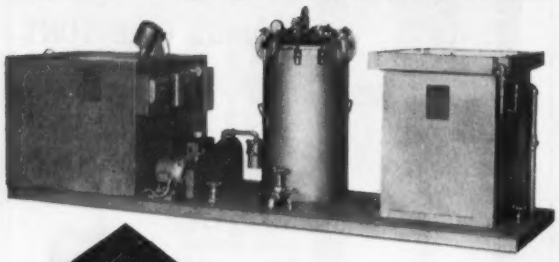

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TWENTY FIVE YEARS EXPERIENCE ALL PHASES OF MANAGEMENT FERROUS AND NONFERROUS, CAPTIVE AND JOBBING. CAPABLE OF COMPLETE CHARGE. CURRENTLY EMPLOYED BUT DESIRE CHANGE. BEST INDUSTRY REFERENCES. ADDRESS: BOX 136 FOUNDRY, PENTON BLDG., CLEVELAND 13, OHIO.

SUPERINTENDENT OR MANAGER

Progressive foundryman familiar with every phase of practical experience on all classes of work. Now employed. Would like to make change. Address: Box 135, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PRODUCTION MANAGER—SUPERINTENDENT

Twenty-three years practical experience steel foundry production. Fully qualified to take complete charge of foundry or production control department. 40 years of age. Presently employed. Address: Box 134, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

COREROOM SUPERINTENDENT

Or general Corerroom Foreman. 19 years experience in gray iron foundry. Age 41. Married with family. Jobbing or production, bench or floor work. Qualified to take complete charge of all corerroom operations. Willing to relocate. Address: Box 115, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOUNDRY ENGINEER

Seven years experience in design and layout of foundry equipment and materials handling. Currently employed. Midwest preferred. Address: Box 130, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

PATTERN SHOP

Interested in locating pattern shop in or around progressive foundry. Have full line of wood pattern equipment. Prefer Minnesota, Wisconsin or Iowa. Will consider any other area. Address: Box 142, FOUNDRY, Penton Bldg., Cleveland 13, Ohio

SUPERINTENDENT-MANAGER

20 years experience as superintendent and manager of ferrous and nonferrous jobbing and production foundries. Sales and metallurgical background. Practical and technical experience in all phases. Age 48. Now employed. Address: Box 131, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• EMPLOYMENT SERVICE

FOUNDRY PERSONNEL SPECIALISTS

National Placement and Procurement of

GENERAL AND PLANT MANAGERS, PLANT SUPERINTENDENTS, FOREMEN—ALL DEPARTMENTS, METALLURGISTS, ENGINEERS, CONTROLLERS, ACCOUNTANTS, SALESMEN, SALES MANAGERS, PERSONNEL DIRECTORS, PURCHASING AGENTS

Confidential Inquiries Invited
From Employers and Qualified Applicants

For Fast Competent Assistance Contact

DRAKE PERSONNEL, INC. **FINANCIAL 6-8700**
JOHN COPE, DIRECTOR, 29 E. MADISON ST., CHICAGO 2, ILL.

• ENGINEERING SERVICE

SPECIAL SERVICE . . .

You may have a PROBLEM which you have been UNABLE TO RESOLVE with your own organization personnel. A problem that could be QUICKLY SOLVED in a month . . . a week . . . a day . . . BY A WELL-QUALIFIED MAN of experience. We have a man or men with many years of experience in the exact areas with which you are concerned. Representative areas include plant layout, modernization, operation, selection and installation of equipment, technical processes, metallurgy, personnel development, methods, etc. To help you, we assign individuals who have 40 or more years of actual experience in specialized fields . . . invaluable know-how, yours to command for as long as you need it. WRITE OR PHONE for detailed information.

WESTOVER SPECIAL SERVICE ASSOCIATES
3110 W. Fond du Lac Ave., Milwaukee 10, Wisconsin, Phone Custer 3-2121

MAGNESIUM PERMANENT MOLDS

Designed and gated. Address inquiry to: Box 101, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• POSITIONS WANTED

PATTERN SUPERVISOR

TOP LEVEL EXPERIENCE MAKING—BUYING—ENGINEERING—SELLING—WITH EMPHASIS ON STRONG ADMINISTRATIVE AND SALES RECORD. FAMILY MAN. WILL RELOCATE. ADDRESS: BOX 129, FOUNDRY, PENTON BLDG., CLEVELAND 13, OHIO.

FOUNDRYMAN

26 years job and production foundry experience. All departments. Gray iron, alloy, nonferrous. Some college. Some college teaching. 18 years supervision. Age 45. Resume on request. Address: Box 125, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• REPRESENTATIVES WANTED

SALES REPRESENTATIVES

Here is an established competitively-priced line you can count on for a good income. Milward Alloys, a leading manufacturer with a strong reputation is now in the process of localizing many sales areas to give better service to customers and prospects from coast to coast. A considerable number of territories are open. We need men who will take them on, full or part time.

You may now be serving the trade or you may have foundry experience. Maybe you're retired with time on your hands. Regardless of your situation, you will be amply rewarded—because Milward's line is broad and in constant demand. Milward alloys cut foundry costs. Orders are promptly filled. That's why we have a substantial reorder business.

The Milward line includes: copper shot; phosphor copper and other powerful deoxidizers and degasifiers; aluminum bronze and manganese bronze hardeners and ingots; copper silicon, copper manganese, copper iron, copper aluminum and copper chrome alloys; nickel copper and nickel iron alloys; aluminum titanium, aluminum silicon, aluminum manganese, aluminum iron and aluminum copper and other alloys.

Phone or send us a letter describing the area or locality you can cover, whether full or part time, and tell us a little about yourself . . . your qualifications, experience, and when available. This may well be the connection you've been waiting for. Write or phone: Mr. David B. Milward, President. Phones: Lockport, N. Y. 4-0435, or Buffalo, N. Y. LUdlow 6425.

MILWARD ALLOYS, INC.
Lockport, N. Y.

• REPRESENTATIVES WANTED

SALESMAN

Wanted salesman that sells foundry supplies to handle molten metal thermocouples and pyrometers for nonferrous foundries. Good commissions and unlimited territory. Well-established instrument manufacturer.

ELEMATIC EQUIPMENT CORPORATION
6731 SOUTH CHICAGO AVENUE
CHICAGO 37, ILLINOIS

SALES REPRESENTATION

Desired in Chicago area by northern Illinois gray iron foundry. Address: Box 118 FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOUNDRY CONSULTANTS

FOUNDRY CONSULTANT-NONFERROUS

Sand casting—permanent mold casting—centrifugal castings — in aluminum — brasses — bronzes —30% leaded bronze—aircraft quality bearings and castings. Address: ED JENKINS, 286 PENOBSCOTT BLDG., DETROIT 26, MICHIGAN, PHONE: WOODWARD 5-7947.

• FOUNDRIES FOR SALE

FOUNDRY FOR SALE

Fully equipped now operating gray iron foundry in western New York State for sale. Located near the New York Power Development. Reason for selling, present owners want to retire.

BOX 132, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

ALUMINUM AND BRASS FOUNDRY

For sale. Fireproof building 7200 sq. ft. In profitable operation, bluechip customers of long standing. Vicinity of Milwaukee, Wisconsin. Address: Box 104, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOUNDRIES FOR SALE

ALUMINUM AND BRASS FOUNDRY

One of the best operations in state of Iowa. Good buildings and equipment. Operating continuously at capacity. Doing all sand castings at present. Large permanent mold account available. Owner has other interest. A real opportunity for a good foundry man. Address: Box 111, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

FOR SALE OR LEASE

Gray iron foundry completely equipped and ready to operate. Large building, approximately 25,000 sq. feet, brick construction. Capacity 45 tons per day. On Santa Fe railroad, 200 miles south of Denver in Trinidad, Colorado. Address: Box 102, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOUNDRIES WANTED

WANTED

We would like to purchase gray iron, malleable or steel foundry. Must have sales from 20 to 50 tons per day. Prefer Ohio location, near or around Cleveland. Will consider others. Equipment and building unimportant as long as good sales volume exists. Will pay cash or trade for stock on New York Stock Exchange. Address: Box 122, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• WANTED-TO-BUY

IF YOU OPERATE A FURNACE

We will purchase your scrap linings, retorts, conveyors, muffles, racks, etc. Any item made of nickel alloy.

Write, Wire or Call:

WEINSTEIN COMPANY
610 W. 8th STREET
JAMESTOWN, NEW YORK
PHONE: 61-154

WANTED-TO-BUY

We have immediate need for the following:
Osborn and Spo Jolt Squeeze Molding Machines
Simpson Sand Mixers, all sizes
American Wheelabrator Tumblasts, all sizes
Melting Equipment of any type and size

call — write — wire today!

UNIVERSAL MACHINERY & EQUIPMENT CO.
1432 N. NINTH ST., READING, PA.
Phone FRanklin 3-5103

BAKER PERKINS MIXER

Wanted—100 gal. to 200 gal. working capacity. Prefer Sigma blades with external bearings.

THE FIBERITE CORPORATION
WINONA, MINNESOTA

WANTED

B&P Motive Jr. Sand Slinger. Late type

BOX 121 FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

• WANTED-TO-BUY

WANTED

2 used cranes—15 ton capacity hoist—30 ft. lift—38'7" span—wheels to run on 35 lb. rail—3/60/220—AC current. Maximum wheel load 25,000 lbs. 125 ft minimum trolley speed. 25-300 ft. min. bridge speed—magnetic controls. 25-30 ft. min hoist speed. Mail complete description and offer to: J. A. Graham, The Dayton Steel Foundry Company, P.O. Box 1022, Dayton 1, Ohio.

MIXER WANTED

Used Simpson Intensive Sand Mixers, State size, condition and lowest cash price for immediate acceptance. Address: Box 103, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

WANTED

Used or Broken Silicon Carbide Grinding Wheels of any kind or size, regardless of bond. Will pay $35.00 per ton. Union Mining Co., 1st Nat'l. Bank Bldg., Pittsburgh 22, Pa.

WANTED

To buy—Reda No. 550 gas and oil fired furnace. Address: Box 113, FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

WANTED

Used Osborn Model No. 3131 Rota Lift Molding Machine. Address: Box 116 FOUNDRY, Penton Bldg., Cleveland 13, Ohio.

• FOR SALE

SAND BLAST EQUIPMENT

SELL-BUY-TRADE

GUARANTEED MACHINES

TERMS: 3 YEARS TO PAY

6' LF-14 Pangborn Table	$2200.00
9' LG-14 Pangborn Table	4500.00
6' Pangborn Swing Table	5000.00
Pangborn 7 GK Barrel	1500.00
Rumelin 8 x 8 Room	1200.00
Pangborn 53 EN2 Hand cabinet	325.00
Pangborn Auto Peening cabinet	1100.00
14 LG5 Pangborn Multi-table 5—5' tables	9000.00
48 x 48 Wheelabrator Tum. w/loader	3500.00
42 x 48 Wheelabrator Tum. w/loader	3000.00
27 x 36 Wheelabrator Tumblast Like new	3500.00
36 x 42 Wheelabrator Tum w/loader	3000.00
Skiphoist—For all Wheelabrator Tumblast	
8' Wheelabrator Table Blast	2000.00
6' Wheelabrator Table Room	5000.00
Pressure Tanks, all types	150.00 up
Vapor Blast cabinets	400.00

All types and sizes of Hand Cabinets, Dust Collectors, Pressure Tanks, Rooms, Horizontal or Vertical Tumbling Barrels and additional Sand Blast Equipment too numerous to mention.

DIAMOND SALES, INC.
5654 W. Jefferson
Detroit 9, Michigan
VI-3-6750

FOR SALE

MOTOR—GENERATORS
TRANSFORMERS

Unused—Rebuilt

WORLD'S LARGEST INVENTORY

ELECTRIC EQUIPMENT COMPANY
Phone station Collect GLenwood 3-6783
P. O. Box 51—Rochester 1, New York

• FOR SALE

FOR SALE

Newaygo "Reddy-sandy" Mod. RS-VM, complete
Bucket Elevator on 20' centers 22—6" x 10" buckets
Eclipse Reverberatory Furnace Model F2000G
Skip Hoist for No. 9½ Cupola
Mold Conveyor 268' long
Osborn #405 Rollover
Vibrating Screens
International Rollover RES, Size 15"—6"
Milwaukee 163 Jolt Stripper
Champion JBL 12 Pin Lift, Jolt
Osborn 710J, Pin Lift
Osborn 212J, Jolt Squeezers
Osborn 275J, Jolt Squeezers
SPO 113 Jolt Squeezer
International LSJ, Jolt Squeezer
International PJS, Jolt Squeezer
Milwaukee 104 Jolt Squeezers
Champion JS 108 Jolt Squeezer
Arcade 1008 Jolt Squeezer
SPO 506 Jolt Rollover, Pin Lift, Draw
SPO 110 Jolt Squeezer
International Rollover 24-10 G, Portable
International Rollover 30 x 8, no jolt
International Rollover 30 x 12 G.
J & J 610 Rollover, portable
International Pin Lifts
Davenport Pin Lifts
Osborn 559 Pin Lifts
International Type R core rollover, hand
Swing Grinders
Royer Sand Preparators
B & P Preparators
Blystone Sand Mixers
American Sand Cutters, Model M
Core Ovens
Grinders, ½ hp to 25 hp
Disc Grinders
Ladles from 50-5,000 lb.
Pouring Devices, 500 lb. to 2000 lb.
Gyratory Riddles
Tramrail & Switches
Air Hoists, 1000 lb. to 4000 lb.
Overhead chain conveyor #458, track, drives
Blowers—Centrifugal—positive—exhaust
17", 20", 28", 36" Spray Booth Fans
Spencer Turbo Compressor, 3600 CFM @ 24 oz., 40 Hp. Motor
AAF Dust Collector, Type N, Size 1½, Wet
AAF Dust Collector, No. 40 Air Mat Dust Arrestor
Spencer Centrifugal Dust Collector, Multiple Vacuum Type, 300 CFM @ 5" of Hg., Vacuum
Turner & Hawes Dust Collector, Atmospheric Dry Filter Non-Automatic Type, Size 2500
Pangborn Dust Collector, Cloth & Screen Type Size 11,000 CFM

FLASKS
ALUMINUM
SLIP AND POP
SIZES FROM 10" x 10" TO 48" x 48"
JACKETS
ALUMINUM AND IRON
STEEL FLASKS
CORE PLATES
TRANSITE—IRON
MANY OTHER ITEMS IN STOCK
SEND US YOUR INQUIRIES
WE BUY—SELL—TRADE

THE HOMAN MACHINERY CO.
1144 HARRISON AVE. MAIN 1-0330
CINCINNATI 14, OHIO

FOR SALE

PREPARATOR #60 Beardsley & Piper good condition—priced to move
CHEMICAL LABORATORY EQUIPMENT (Complete) w/Dietert Carbon and Sulfur Determinators—ready to use
CRANE MAGNET 45" Diam. EC&M Welded Type
BONDACTOR Unit, inc./#2 Open-Gear SIMPSON MULLOR for coating gannister w/bucket elevator and storage hopper to load machine—save up to $8 per ton on your cupola patching material.
OSBORNS—#275-J, #276-J, #559, #332-48, #712-J, and #716-J

Other good equipment.

W. O. McMAHON
BOX 5799, HOMEWOOD STATION
BIRMINGHAM 9, ALABAMA
Phones TRemont 1-2088 and 9-6170

• FOR SALE

FOR SALE

ELECTRIC MELTING FURNACES
Single Phase

1—DETROIT "LFA" 350# shell 13200V.
1—DETROIT "LFC" 700# and 350# Tapered Shell 2300V.
30 KW Lepel

FLASK HOIST—ROLLER CONVEYOR
NATIONAL 24"; 8' long table
FURNACE TRANSFORMERS
1—"LECTROMELT" 800 KVA, 12000V, 3 phase
PENNSYLVANIA 750 KVA, 13200 V., single phase.
1—WESTINGHOUSE 500 KVA, 11200 V., 3 phase.
1—WESTINGHOUSE 2500 KVA, 13800 V., 3 phase.

FURNACES NONFERROUS
CAMPBELL HAUSFELD Stat'y., pot type
1—HEVI-DUTY HD-181-S Pot type, electric
2—400# FISHER Gas Fired Tilting Furnaces
1—600# FISHER Gas Fired Stationary Furnace
1—CAMPBELL HAUSFELD Oil Fired 625# brass hand tilt
1000# STROMAN DC double dipout w/complete controls

ACME EQUIPMENT CO., INC.
126 SOUTH CLINTON STREET
CHICAGO 6, ILLINOIS

BEST BELT BUYS

Heavy duty, unused, 2500-3000 # cover tensile, 16-19 # friction pull, 3 weeks delivery.

4 ply 28 oz. duck:		LIST	SELL
14" — 1/8" x 1/32"		$4.31	$2.42
16" — 1/8" x 1/32"		4.86	2.72
18" — 1/8" x 1/32"		5.40	3.02
18" — 1/8" x 1/16"		5.69	3.19
20" — 1/8" x 1/32"		5.90	3.32
24" — 1/8" x 1/32"		6.95	3.90
24" — 1/8" x 1/16"	(5 ply)	8.54	4.78
4 ply 32 oz. duck:			
24" — 1/8" x 1/16"		7.79	4.36
30" — 1/8" x 1/16"		9.58	5.36

Many other sizes. Samples on request. Distributor Inquiries invited.

PALTECH CO.
NEW CANAAN, CONN.
WO 6-4073

• FOR SALE

FOR SALE

1—#3 Wheelabrator Multi-Table having 4—48" tables. Full controls, 220/440 volt, 60 cycle.

1—#65 Dustube Collector.

All in first class condition.

1—Battery of 2 Foundry & Equipment Co., Coleman Transrack Core Ovens, Oil Fired. 13' 8" long x 14' 10" wide x 7' 9" high.

Overall outside dimensions. Fiberglass insulated. All controls. This oven used very little, perfect condition.

THATCHER FURNACE COMPANY
GARWOOD, N. J.
TELEPHONE SUnset 9-1000

FOR SALE

Wheelabrator Tumblast 48" x 48" Serial No. A-81387 with loader and electrically operated door. New conveyor flights and link assembly. A-1 condition.

WHITEWATER MANUFACTURING COMPANY
WHITEWATER, WISCONSIN

FOR SALE

CORE BLOWERS, rebuilt and guaranteed

2—Demmler model #55

1—Taccone bench type, horizontal or vertical clamping.

BOX 126, FOUNDRY
PENTON BLDG. CLEVELAND 13, OHIO

• FOR SALE

FOR SALE

Clearfield #404 Muller 4 cu. ft.
Simpson #0 Muller Style "C"
Simpson #1½ Muller Style "C"
Milwaukee Jolt Pin Lift 30x60 Table
Osborn #712 PJ Jolt Squeeze Pin Lift
Tabor rollover 30x40 Table 12" Draw Air Clamps
Tabor Jolt Hand Rollover 20x22 Table
Tabor 5 HP Abrasive Cut Off Saw
Tabor 10 HP Abrasive Cut Off Saw
Redford #2 Core Blower w/air clamps
Demmler #1 Core Blower (New)
I-R 10000 lb. Air Hoists
I-R Air Trolley for 10000 lb. Hoists
Lindberg 6' x 8' x 8' Al. Heat Treat Furnace complete with controls, etc.

We will buy one piece or a complete plant.

PEK MACHINERY CO.
114 COLDEN ST.
JERSEY CITY 2, N. J.
HE 2-2898

FOR SALE

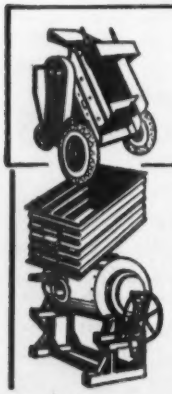
1—American Wheelabrator Tumblast 36" x 42" Excellent condition $3500.00
1—American Wheelabrator Dust Collector 3200 CFM 750.00
1—#4 Gisholt Lathe Ram Type 1945 3250.00
1—Caze-Neuve Lathe 18" x 80" Tracer Head and complete tooling. (1954) 6500.00
Above equipment FOB Milwaukee, Wisc.

NORTHWEST MACHINE
2231 NORTH KENNETH
CHICAGO 39, ILL.
BE-5-8153

FOR SALE

1—Simpson #0 Muller—Style M (never used)
1—Simpson 18" Muller
1—Lancaster Mixer, Model EBG-4
1—Lancaster Mixer, Model EAG-3
1—Ingersoll Rand Air Compressor, Type PRE-2, 24" x 16", 100# pressure with 300 HP Motor.
3—Link Belt Roto-Louver Rotary Dryers, Models, 207-10, 310-16, and 604-20.

R. GELB & SONS, INC.
U. S. HIGHWAY 22, RAHWAY VALLEY R. R. UNION, NEW JERSEY



EUCLID FOUNDRY & MACHINE EQUIPMENT CO.

14919 SARANAC ROAD — CLEVELAND 10, OHIO

WHEELABRATORS
1—20" x 27", 2 cu. ft. Tumblast
1—42" x 48", 17½ cu. ft. Tumblast with loader
1—6' Table Airblast w/six aux. tables

MOLDING MACHINES (Automatic)
2—TDA4 Taccones

WANTED!
COMPLETE FOUNDRIES,
SMALL/LARGE.
PROMPT SERVICE.

CORE OVEN
1—Di-Electric, Model CD-25
Coleman, 30 KW.

SWING GRINDERS
10—10 H.P. Mummert-Dixon Model 1814
3—25 H.P. Safety Grinding Wheel Model 204

ELECTRIC FURNACE
1—Ajax—Tama Wyatt, 300 lbs. aluminum per hr., 60 KW, 100 KVA, 460v, 1 ph., 60 cy.
1—Heat-Treat, Lindberg, 72 x 84 x 96, car type, 105 KW, 220v, 3 ph., 1250°F.
1—350 lbs. Detroit Rocking

— GLENVILLE 1-1222

Circle 871 on Page 53

THE ACME BARGAIN PAGE

AERATOR
NEWAYGO

BELTING
29" x 180' 24" x 152'
24" x 263' 24" x 120'

BLOWERS
GE 10500 cfm., 20 oz., 85 hp., 220 V.
GE 7500 cfm., 20 oz., 89.6 hp., 220-440 V.
GE Centrifugal 6200 cfm., 24 oz., 58 hp. motor
SPENCER 7350 cfm., 16 oz., 50 hp.
SPENCER 2250 cfm., 16 oz., 15 hp., 220 V.
Ingersoll-Rand 12900 cfm, 100 h.p. 220-440V. 20 oz.
McKee 200 cfm
North American 850 cfm.
NORTH AMERICAN 1050 cfm., 16 oz.

BUFFERS
6—HAMMOND VROL 3 hp variable speed
HAMMOND 5-VRO 5 hp variable speed
STANDARD 20 RSB 20 h.p.

CLEANING EQUIPMENT
Model 4836V-B VAPOR BLAST
VACU-BLAST C9-D5

CONVEYOR OVERHEAD CHAIN
700' JERVIS B. WEBB and LINK BELT #678 with trolleys 36" centers 2-5 h.p. Variable speed caterpillar drives.

CONVEYOR
17' BARBER GREEN Bucket Conveyor
30" x 25' Magnetic Belt Conveyor w/drives, 2 hp., 220-440 V.

CORE BLOWERS
CHAMPION CB15 55# cores
DEMMLER #2, 20# cores
DEMMLER #2K, 20# cores
REDFORD Bench types, horizontal or vertical clamping
CB15 55# cores, Universal blow plate
DEMMLER #4 up to 250# cores
FEDERAL "SAN-BLO" CB 4C
INTERNATIONAL SB15H, up to 150# cores. Hydraulic clamp and draw
INTERNATIONAL SB 13, up to 60# cores
INTERNATIONAL SB 12, medium sized cores
6—OSBORN 193 up to 50# cores
OSBORN 2035-2 large sized cores

CORE GRINDERS
5—MILWAUKEE 70-9 & 70-12s
1—OWOSSO DE1-303 42" table

CORE OVENS
THERMONIC INDUCTION MODEL 1800A
5—DESPATCH, Gas Fired, 3 Drawer

CORE ROLLOVERS
INTERNATIONAL REDP Rollover 12" draw

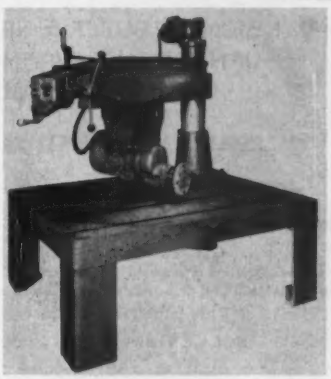
CRANES
P&H 3 TON Electric Traveling DC motors 50' span
270' Crane Runway and Supports
10 ton MILWAUKEE; 48' span, 220 V.

CUPOLA GUNS
1—BONDACTOR #1250
BONDACTOR #1000

DUST COLLECTORS
PARSONS 40,000 cfm. cloth bag type
ROTOCLONE, Size 6, Wet Type, 3000 cfm
ROTOCLONE N-15 h.p. 6600 cfm
ROTOCLONE W14 Arrang. A, 5200 cfm.

GRINDERS, SWING FRAME
FOX 24" x 3" x 12", 15 h.p.
MARSCHKE 24" x 3" x 12" 20 hp., 220 V.
U.S. 24" x 3" x 12" 15 hp., 220-440 V.
2—MARSCHKE 3 hp., 12" wheel
1—B&D 7½ hp.

GRINDERS, MISC.
U.S. #70 Combination 20" disc and 20" x 3" x 1¼" wheel
GARDNER 18" single end disc.
HANCHETT 30" double spindle opposed
GARDNER 26" D.E. Disc.
GARDNER 30" D.E. Disc.



10—DEWALT CUTOFF SAWS for ferrous or nonferrous metals, cutoff or as sprue cutters. Flush blade adaptor takes up to 20" abrasive blade or saw. Power Hoist to arm. Chain & sprocket cross feed for working on heavy cast iron 48" x 60" "T" slot table or off table cutting of large work. Motor swivels horizontal to vertical in yoke.

HEAT TREATING FURNACES
HOLDEN #202 Electrode Type, Bright hardening annealing 1850°

HOISTS
2—4000# Lo Hed, 220/440V
10 ton SHAW BOX electric hoist
4—INGERSOLL-RAND Air trolleys
1—500# INGERSOLL-RAND LC-4
4—CLEVELAND 2000# Cab type hot metal carriers

INDUCTION MELTING EQUIPMENT
100 KW-Ajax 300# 3000 cycle, 150 h.p. 4 bearings MS set, water cooled, complete controls
30 KW Lepel Spark Gap
35 KW Ajax Tama Wyatt, 60 cycle induction holding furnaces
1000# Ajax Spare Melting Furnaces—Unused

LADLE MIXING
4000# Industrial, Insulated

MOLD BLOWER
TACCONE TD4 24" x 32" flask

MOLDING MACHINES
JOLT SQUEEZE PIN LIFT
3—Milwaukee 165
2—OSBORN 712 PJ 18" x 28" table
1—CHAMPION JSL10P 18" x 21" table 6" draw
2—#2114G SPO table, 20" x 27"-11" cyl.

SPECIAL! FACTORY REBUILDING
8—MILWAUKEE 2646 Jolt Squeeze Strip rolloff — rolling molding machines 10" jolt cylinder; 1800# capacity, 26" Squeeze cylinder; 13" draw, Flask size 25½" to 29" wide, 52" long. FACTORY REBUILT.

JOLT SQUEEZERS
4—CHAMPION, JS10P 18" x 21" table
2—OSBORN 275PJ
2—MILWAUKEE 244 Jolt Squeeze car type head
MILWAUKEE 181-7, 24" x 36" table

JOLT ROLLOVER DRAWS
HERMAN 10000# late
HERMAN 3000#
2—750# HERMAN 20" x 30" table
1—INTERNATIONAL RJ 20" x 12"
3—SPO 9032

JOLT SQUEEZE ROLLOVER DRAW
2—#331 OSBORN 24" x 30" flask area, 7" draw

JOLT PIN LIFTS
MILWAUKEE 3000#, 38" x 42"
2—INTERNATIONAL 1200-8 26" x 27" table, 8" draw

PLAIN JOLT
40" x 84" Herman
36" x 60" Herman

MULLERS and MIXERS
1—#60 B & P
1—#80A B & P
2—#3 UD Simpson
1—930 Clearfield
1—#1 Simpson Muller

B & P #30 w/skip multrol, also has cooling or heating coils for plastic or shell.

SAND CUTTERS
AMERICAN 51"
JEFFREY SANDITIONER
Model M. Screenerator

SAND SLINGERS
1—B&P Tractor, 19" heads
MITIVE JR., 19" 2 speed head.

SAND SYSTEMS
2—NEWAYGO SUPER HANDY SANDY; like new

SAWS, BAND
30" LAIDLAW, Metal Cutting hydraulic feed
42" TANNEWITZ, 5 hp., 220-440 V.

SHAKEOUTS
3' x 5' ROBBINS
3' x 5' SIMPLICITY
5' x 6' SIMPLICITY
4' x 10' SIMPLICITY

SHELL EQUIPMENT
SHELL PRODUCTS 20" x 30" pattern size w/shell blender and bonding press

SHOT BLAST
SLY #4, 20" x 30" w/dust collector

SPRUE CUTTERS
1—MILWAUKEE #85 TON

STRAIGHTENING PRESS HYDRAULIC
150 ton HPM
150 ton Farquhar "C" Frame
100 ton Watson Stillman "C" Frame
60 ton Lempco 4 post
60 ton Farquhar "C" Frame

TESTING EQUIPMENT
ARLIN Automatic Rockwell, continuous type
COLEMAN 55 Spectrophotometer
GOGAN Model 1414-2V
TYLER ROTAP Testing Sieve w/screens
TINIUS OLSON Brinnel Hardness Tester Production
TINIUS OLSON Brinnel Hardness Tester Bench

TUMBLING BARRELS
1—ROYERSFORD, 42" x 72", chain drive, late
WHITING 60" x 72" 20 hp. drive
SLY, 24" x 42"; 3 H.P.

WHEELABRATORS
27" x 36" American w/skip
48" x 48" American Gun type Cabinet
2—20" x 27" AMERICAN, w/rubber belt
1—42" x 48" AMERICAN Skip Loader.
AMERICAN #2 Tablast 8-28" tables, late
PANGBORN LD1-Airblast Table
PANGBORN GD1-Airblast Barrel

WOODWORKING—PATTERNSHOP
GARDNER 30" DISC and Spindle Sander
HERMANCE 24" Planer
JONES SUPERIOR 48" Double Disc
BOICE CRANE 12" Planer
OLIVER #290 Dbl Arbor, Tilt-Arbor Saw
1—OLIVER 182D, 15" Disc Sanders
WALLACE 8" Jointer
CRESCENT 24" Planer
TANNEWITZ 42" Band Saw
ONSRUD W-244 & W-240 Routers
8", 12" and 30" Jointers
16", 32", 36" Band Saws

WIRE STRAIGHTENERS
1—#2A Climax ¼"
B-21-Multiplex Wire Bender & Cutter

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USED, REBUILT & NEVER USED HEAT TREAT FURNACES AT SAVINGS UP TO 60% OF NEW EQUIPMENT

GRAY IRON ANNEALING FURNACES

PUSHER

58" x 31" x 48" E.F.C. 250KW w/preheat 1650° F.

50" x 34' x 12" G.E. 238KW 1750° F. For use w/controlled atmosphere. Includes work trays & (1) 1500 CFH G.E. Exothermic Generator. 2 available. Excellent condition.

ROLLER HEARTH

50" x 25' x 18" Westinghouse 240KW 1550° F. For use w/wo protective atmosphere.

53" x 30' x 27" Stewart Sunbeam 750KW 1550° F Complete w/8500 CFH atmosphere generator. Like New condition.

MESH BELT

20" x 10' x 12' Surface Combustion, gas fired, 1650° F.

54" x 25' x 27" C. I. Hayes 198KW 1650° F. For use with or without protective atmosphere. Like New condition.

BELL

36" dia. x 72" H Westinghouse 120KW 1500° F. Complete w/2 B&R. & Ammogas Generator.

59" dia. x 50" H. Westinghouse 100KW 1400° F.

ELEVATOR

2' x 10' x 4' G.E. 200KW 1650° F.

7' x 14' x 7' G.E. 700KW 1650° F.

CAR BOTTOM

5' x 12' x 3' Johnson 1650° F., gas fired, w/2 cars'. Brand New.

ALUMINUM & GRAY IRON STRESS RELIEVING & AGING FURNACES

BOX

18"x36"x18" Heviduty 30KW 1850° F

36"x48"x24" Lindberg 45KW 1250° F
60"x120"x42" Lindberg 160KW 1250° F
66"x60"x57" Industrial gas 1250° F

CONTINUOUS SLAT CONVEYOR

70"x24'x25" Gehnrich Gas 200° F - 1000° F Like New - 2 available

18"x10'x4" Stewart Sunbeam Gas 1400° F Mesh Belt Type "Brand New".

OVENS — GAS & ELECTRIC

60"x48"x60" Coleman Gas 800° F Shelf type
60"x36"x30" Gehnrich 20KW 800° F Shelf type (2 avail.)
53"x108"x70" Mayer Gas 750° F Walk-in.

PIT TYPE ELECTRIC

20"x26" L&N 45KW 1400° F
22"x26" L&N 45KW 1200° F
28"x28" L&N 60KW 1400° F
40"x48" L&N 75KW 1400° F
22"x36" Lindberg 52KW 1250° F
28"x48" Lindberg 52KW 1250° F
48"x60" Lindberg 90KW 1250° F

PIT GAS

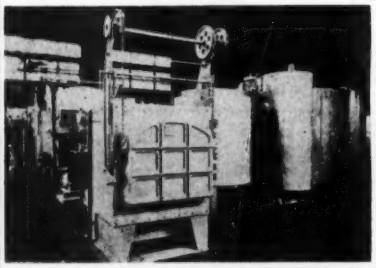
25x20 Lindberg 1250° F (9 available)
25x30 Lindberg 200° F - 1750° F
48x60 Lindberg 1250° F
48x72 Lindberg 200° F - 1750° F (2 available)

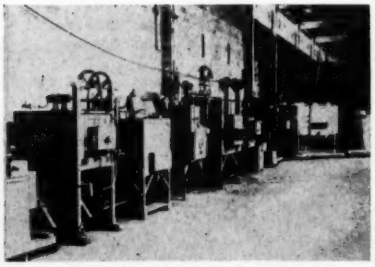
ALUMINUM & STEEL INDUCTION MELTING

6 - AJAX 35KW - hold 300# aluminum, 500# brass Melt 175# aluminum/hr., 210# brass/hr. Like New condition w/complete J.I.C. spec control panels.

1 - 20KW AJAX w/2 - 20# Furnaces. Complete w/controls & crucibles.

1 - 350KW ALLIS CHALMERS 960 cycle converter steel melting with 2 - 600# furnaces & controls.





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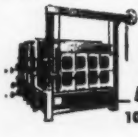

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AIR & ELECTRIC HOISTS

85—I & R Air Motor type, sizes A, B, C, D, D-6 & E, ½, 1, 2, 3 & 5 ton.
15—DETROIT Air Hoists, 1, 1½, 5ton cap.
1—DETROIT Model LHR, 5 ton, elec.
20—THOR air hoists, ½, 1 & 2 ton cap.

BUCKET ELEVATORS

12—LINK-BELT & JEFFREY, 30, 40, 50, 60 ft. cc, 10 x 7, 12 x 7, 14 x 7, 16 x 8 buckets.

CUT-OFF MACHINES

1—TABOR C10AF, 16" wheel, 10 HP.
3—TESSEMER H & I Sprue Cutters.

CORE BLOWERS

3—CHAMPION Model CB-10, CB-18, & CB-400. From 10 to 300 lb. Cores.
22—DEMMLER #50 Model 1, 1E, 2, 2E, 2K, 3, 3E, 3K, 4 & 4E. 10 to 100 lb.
1—FEDERAL 40P-1 San-Blo.
7—INTERNATIONAL Model SB-11 & SB-13, SB-15H, 15 to 30 lb. Cores.
6—OSBORN Nos. 91, 92, 192 and 193. From 10 lb. to 75 lb. Cores.
2—REDFORD #2—Magazine type.
1—SAN-BLO Model CB-40-B, 40# Cores.
1—SPO Model SC-10-DM, hollow core.

CORE OVENS

1—INDUSTRIAL "Revolving Carriers" continuous 18" x 80" trays.
2—PORBECK Batch type 10' L x 8' W.
1—DESPATCH Type "B" 6' w x 16½' l x 7½' h Oil Fired.
1—FOUNDRY EQUIP. 3 comp. 6' x 7' x 12' ea. Gas or oil.
1—THERMONIC Model M800A Dielectric. Cap. 900#s per hour.

CUPOLAS, BLOWERS & EQUIP.

1—SPENCER 150 HP 7500 CFM 48 oz.
6—I & R Centrifugal 30, 50, 85 and 100 HP. 3500 to 10,500 CFM w/blast gates.
1—CUPOLA Bondactor, style 1205-L.

ROTO-CLONES WET TYPE

9—AMERICAN AIR FILTER Type N&W, Sizes No. 20, 24, 27, & No. 30, w/sludge ejectors, cap. to 30,000 CFM.

ELECTRIC MELTING FURNACES

4—DETROIT LFA, 350# Cold Charge 700# Molten w/200 KVA transformers.
1—TOCCO 20 KW Induction, 9600 cycles.
3—AJAX No 100 & 300 Furnaces Only.
6—AJAX 35 KW Induction 460 V 1 phase.
1—DETROIT Size CM—4000# Charge, 8000# Molten, w/1000 KVA trans.
2—AJAX 20 KW Hi Frequency Converters.

GAS & OIL FIRED FURNACES

23—LINDBERG FISHER Model MNP electric Tilt. Sizes 150, 400, 600, 1000, 1700, 2000 & 2400#, alum. cap. Gas or Oil.
29—LINDBERG & HAUSFELD Stationary, Sizes 100, 150, 200 & 550 cap.
1—LINDBERG #400 BBI hand tilt.
1—SKLEENAR 1200# Rev., hand tilt.
1—MONARCH 600# Rev., hand tilt.
1—STROMAN, "U" 600# Reverb.
1—STROMAN DC "Dipout" 800# cap.
1—ECLIPSE E1000—Double Chamber Dry Hearth 1000# cap.

GRINDERS

Swing Frame

1—FOX #4 Wheel 24" x 3"—20 HP
1—MARSCHKE 20" x 10" wheel, 10 HP.
3—MARSCHKE 24" x 3" wheel, 15 HP.
2—U. S. ELEC. Model 24, wheel 24" x 3".
1—MUMMERT-DIXON #2420, wheel 24" x 3".

Snagging

4—FOX #7—30" x 3" Wheel, 15 HP.
2—U. S. #64, 20" x 3", 7½ HP. 4 speed.
2—SAFETY #174, 24" x 3" wheel, 10 HP.
2—MARSCHKE 24" x 4" wheel, 20 HP.
1—U. S. #65, 30" x 3", 15 HP, 4 Speed.
U. S. No. 62VS, 24" wheel, 2-7½ HP motor, variable speed.

Core

2—MILWAUKEE 70-12, 70" dia. table.
1—STONEY Core Grinder, 16" dia. Wheel.

Horizontal Disc

GARDNER No. 124—53" wheel, 20 HP.
GARDNER No. 179, 70" dia. wheel, 40 HP.

LADLES

17—MODERN & WHITING Cylindrical Ladles, 275, 2450, & 3000 lbs. capacity. All Enclosed Gears.
37—MODERN & WHITING Lip Pour, Enclosed Gear, 1200, 1600, 2000, 4000, 6000, 7000, 8000 lbs. capacity.
7—MODERN & WHITING Mixing Ladles, 2 & 3 ton. Electric & Manual Tilting.

MOLDING MACHINES

Jolt Squeezers

12—OSBORN No. 275-J—17x20 Table, 10"
15—OSBORN No. 276-J—17x26 Table, 13"
2—OSBORN No. 216-PJ—21-32 Table, 16"
6—MILWAUKEE 123—17x26 Table, 12"
2—MILWAUKEE 181—24x36 Table, 18"
10—INT. PVJS—20x26 Table, 12" cyl.
9—SPO No. 110-J—17" x 20" Table, 10"
8—SPO No. 113-J—17" x 26" Table, 13"

Plain Jolt

1—J&J 50 x 72 Table—5000# cap.
2—OSBORN 60" x 72" table, 6000# cap.
1—TABOR 36" x 36" table, 1000# cap.

Jolt Rollover Pattern Draw

1—DAVENPORT 28A, 28" x 44" table.
1—DAVENPORT 28-8A, 29" x 40" table.
2—HERMAN 20" x 30"—750# series.
2—HERMAN 26" x 48"—1500# series.
2—HERMAN 50" x 60"—300# series.
2—HERMAN 40" x 48"—400# series.
1—HERMAN 60" x 84"—6000# series.
1—HERMAN 60" x 84"—10,000# series.
14—INTERNATIONAL TYPE G, Sizes 20" x 8", 24" x 10", and 30" x 8".
1—J & J #920 RC—44" x 54"—Hyd. head.
1—J & J #1020 RC—50" x 60"—Hyd. head.
2—J&J #612, 24" x 30" Table.
4—J&J #918, 44" x 54" Table.
1—J&J #815-B, 30" x 40" Table.
1—MILWAUKEE #167, 32" x 33" Table.
10—OSBORN #40 and 42 Core Rollovers.
1—OSBORN #442, 21" x 31" Table.
2—OSBORN #242W, 29" x 42" Table.
12—OSBORN #601 & 602, 30" & 36" Wide Flask, 10" draw, 750 lbs Cap.
2—OSBORN 643 Table 35" x 50"—2000#.
1—SPO No. 9546—26" x 32" Table.
1—SPO No. 917-A—40" x 29" Table.
1—SPO #413D, 24" x 25" Table.
1—SPO Model 508, table size 28" x 30".
1—SPO 5050, Table 25" x 30", 10" draw
3—TABOR 30" x 40" Table, 12" Draw.
4—TABOR 22" x 42" table, 10" Draw.

Jolt Pin Lift

2—DAVENPORT #34 AJS.
3—INTERNATIONAL JDP 1600 x 10" draw, 36" x 36" Table.
2—INTERNATIONAL JDP 3000# x 10" Draw 48" x 48" table.
1—J & J #8125—30" x 38" Table—10" draw.
1—MILWAUKEE #2542.
2—J & J No. 688 25" x 30" table, 6" draw.
2—MILWAUKEE No. 1030—30x38 Table.
1—MILWAUKEE No. 1536 32x38 Table.
3—MILWAUKEE No. 3545—44x48 Table.
2—OSBORN #559, 25" x 30" table.
1—SPO #3058, 22" x 28" table, 8" draw
2—SPO #3070, Table 26" x 35", 10" draw

Pin Lift

2—B & P Model AL 2428 Speed Draw.
1—MILWAUKEE #620 ND Push
2—MILWAUKEE No. 195.
2—INTERNATIONAL #PK-16.

Jolt Squeeze Pin Lift

1—MILWAUKEE #125, 21" x 27" Table.
3—MILWAUKEE No. 165, 24" x 30" table.
3—MILWAUKEE #196, 17" x 38" Table.
1—OSBORN #712-V, 18" x 26" Table.
2—OSBORN #710-J, 17" x 21" Table.
9—OSBORN 714PJ, 20" x 31" Tables.
1—OSBORN #818—24x36 Table, 18" cyl.
1—MILWAUKEE #246—23¼x42 Table.
4—INTERNATIONAL PKL, 17" x 26".
1—SPO #2136-6.
2—SPO 2114P, Table 21" x 27", 11" cyl.
2—SPO 2160-R, Table 24" x 30", 16" cyl.

Shell Molding

1—SHALCO, Model HO4, 2 station.

CONVEYORS

Steel Apron

9—JEFFREY & LINK-BELT 24", 30", 36", widths. Lengths built to your specifications, with reducers & motors.

Oscillating & Vibrating

1—LINK-BELT 48" x 154', 20 HP Motor.
7—JEFFREY TAYLOR No. 5 Vibrating Feeders 24" wide x 7'.
LINK-BELT "FLEXMOUNT"
1—8" W x 50' L x 4" deep pan
2—18" W x 18' L x 4" deep pan
2—SIMPLICITY 24" W x 13' L x 6" Deep.
1—SIMPLICITY 18" W x 11' L x 6" Deep.
1—SIMPLICITY 24' w x 19' x 6".

Roller

2500' MATHEWS 6", 14" wide, 2-7/8" dia. roller, 1¼" hex shaft, 4" channel.
1500—MATHEWS 8" wide, 3½" dia. 1" hex shaft on 6" centers, 6" channel.

Maid

1—DUO-ROLL 88 Cars 20" x 48", 350' track, with automatic dumping.
1—PALMER "B" 106 Cars—42" x 62" w/550' Track.

Belt

LINK-BELT & JEFFREY 18", 24" & 30" wide. Flat or trough idlers, all Timken bearings. Built to your specifications. Can be equipped with molders hoppers & Ploughs.

HOPPERS & STORAGE BINS

1—NATIONAL ENGINEERING "Moulders Helper" 2 Hopper Unit.
7—NATIONAL & LINK-BELT Storage Bins, 60 to 150 tons cap.
1—NEWAYGO HS-7-GT, Handy Sandy.
42—MOLDERS Hoppers 1½ ton cap.

SAND MULLERS

3—B & P No. 80A Speed Muller—24 cu. ft. air cooled.
1—B&P #3½ Mulbaro, 3½ cu. ft.
1—B&P #30 Speedmullor, 4 cu. ft., w/skip Hoist Loader—Air Cooled.
1—B&P #50 Speedmullor, 9 cu. ft., w/skip Hoist Loader—Air Cooled.
1—B&P #60 Speedmullor, 12 cu. ft., w/skip Hoist Loader—Air Cooled.
1—B&P #70 Speedmullor, 18 cu. ft.
1—BESSER Paddle Type, 30 cu. ft.
1—CINCINNATI 24" muller.
2—CLEARFIELD No. 610 w/skip hoist loaders, 10 to 14 cu ft batch.
1—CLEARFIELD #404, 4 cu. ft. batch.
1—DRAVO-DOYLE 6 cu ft cap, Port.
1—LINK-BELT 48" x 8' Paddle Type.
2—MASTER 400# Shell Type 5' pan dia.
1—PEKAY No. 160-1-24 Mixer Muller, single stage for 24" belt, 230 TPH.
1—SIMPSON #1-H Style UD, 400# batch
2—SIMPSON #1½ style UD, 700# batch w/loader.
2—SIMPSON #2, Style C, 1500# w/loader.
3—SIMPSON #3, Style C, 3000 lb.
3—SIMPSON #3, Style UD, 3000 lb.
2—Mixer Muller, 6 cu ft paddle type.
1—LANCASTER No. EDG-4, 5 cu. ft.
1—LANCASTER #EA-4, 6 cu. ft. w/loader.

SAND PREPARATORS

6—B & P Screenerators, Models S, M & L.
8—ROYER Models, NC-4, NDS, NDP.
6—AMERICAN Sand Cutters, Model M, Sizes 79/60, 89/70, 99/80. All late.
4—AMERICAN Model AA and AM, 45" & 60" Cutting Blade.
1—AMERICAN "Sand Master," 102"/70" Cutting Blade—1952.
2—MOULDERS' FRIEND 50" & 60" Brush.
2—NEWAYGO RS-V Reddy Sandys.
1—SIMPLICITY LP 2' x 3' screen.

SANDSLINGERS

1—B&P 5-ton capacity Plate Feeder
2—B & P Tractor Type 19" head & 16" head, 13' arms. Magnetic towers.
6—B & P Models DB Stationary Sand Slingers, 16", 19" and 22" heads with 20, 25, 40 and 50 HP motors. All late.
2—B & P Swing Type Slingers 19" head.
4—B & P 8 ton plate feeders.
2—B & P 35 ton capacity plate feeders.
6—B & P Tanks for speed slingers.
1—B&P Motive 15' Jib—6' Ram—19".
1—B&P Motive Jr. 8' Jib—4' Ram—19".

SHAKEOUTS & SCREENS

2—LINK-BELT 5' x 10', 6 ton cap.
3—SIMPLICITY 4' x 6' Model B.
1—SIMPLICITY 4' x 8' Model D.
1—SIMPLICITY 4' x 10' Model D.
1—SIMPLICITY 5' x 8' Model D.
1—NATIONAL ENG. 5' x 8' Hex Screen.
1—HEWITT-ROBINS 36" x 78" Vibrex.
1—SIMPLICITY 4' x 10' Model B. Single deck sifter screen, 10 HP motors.
2—ROBBINS 3' x 4' JF6—2000#.
1—ROBBINS 6' x 10' JF11—20,000#.

SAND BLAST EQUIPMENT

2—AMERICAN 36" continuous Tumblasts
1—AMERICAN 36" x 42", w/skip hoist.
2—AMERICAN 48" x 42", w/skip hoist.
1—AMERICAN 27" x 36", w/skip hoist.
1—AMERICAN 48" x 48", w/skip hoist
1—AMERICAN 48" x 72" w/loader.
1—AMERICAN No. 2 Tablast—6' dia. Plain Table.
1—AMERICAN #3 Tablast, 4—48" tables.
1—PANGBORN Model 6-LF, 6' diameter plain table with dust collector.
1—PANGBORN 6 LG-14 Multi-Table, 6-24" tables, w/dust collector.
1—PANGBORN Model 14GK-7 Roto-Blast barrel w/loader.
1—PANGBORN 9LG-14 Multi-Table w/6—36" dia. Aux. Tables w/Dust Collector.

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UNIVERSAL REBUILT EQUIPMENT GUARANTEED

AIR COMPRESSORS
1—75 hp INGERSOLL-RAND water cooled, horizontal
1—100 hp WORTHINGTON air cooled, 2 stage

AIR HOISTS
14—INGERSOLL-RAND ½ ton, 1 ton, and 2 ton.

BLOWERS
25—CENTRIFUGAL 16 oz., 2 to 5 HP
10—GE, WILBRAHAM - GREEN, FISHER Positive Pressure & Cent. Cupola Blowers

CLEANING EQUIPMENT & TUMBLING BARRELS
1—15" Continuous WHEELABRATOR
1—26" Continuous WHEELABRATOR
1—15" x 20" WHEELABRATOR Tumblast
1—20" x 27" WHEELABRATOR Tumblast
2—27" x 36" WHEELABRATOR Tumblast, one rubber belt, one steel conveyor
1—36" x 42" WHEELABRATOR Tumblast
1—48" x 42" WHEELABRATOR Tumblast,
1—24" WHEELABRATOR Swing Table
1—1-A WHEELABRATOR Multi-table with 6—26" aux. tables, 10—16" aux. tables
1—PANGBORN TABLAST, 8' Table, 2500#
1—PANGBORN 6'LK Table Room
1—PANGBORN Room, Type 23 "MS," 5' x 2' x 5' table
1—SLY, 68" x 32" Round
4—SLY, 48" x 36" Round

CONVEYORS
1—HEWITT-ROBINS Oscillating, 18" W x 40' L
1—HEWITT-ROBBINS Vibrating, 18" W x 10' L, Model VC-I
1—LINK-BELT Bucket Elevator, 8" x 12" buckets on 14" rubber belt, completely enclosed by 2" x 4" casing.
1—LINK-BELT, CAR type mold, 114 cars, 403' track, car size 18" x 42"
130'—36" Roller Conveyor, heavy-duty, mounted above the rail.
1—SIMPLICITY, 24" x 10" Feeder w/hopper, Model OA-10-JA2

CORE BLOWERS
1—CHAMPION CB-5, Bench Type
10—DEMMLER #1, #2, #2A, #3K, #4E
3—INTERNATIONAL SB-13
3—OSBORN #91, #192, #91-10
1—RANDALL MODEL "A," Bench Type
1—TACCONE #4D, 10" Draw Stroke Cyl.

CUPOLAS
1—SKIP CHARGER for #9 Cupola with scale and buckets
1—WHITING Skip Charger for #5 Cupola
1—WHITING #3½
1—WHITING #6

DUST COLLECTORS
COMPLETE STOCK—both Wet & Bag Type —send us your requirements

FURNACES—DIRECT ARC MELTING
1—250 lb. LECTROMELT, Side Charge
1—500 lb. LECTROMELT, 200 KVA trans.
1—1000 lb. SWINDELL
1—2000 lb. HEROULT
1—2000 lb. SWINDELL, 3/60 1000 KVA.
1—1½ Ton HEROULT
1—3 Ton LECTROMELT, Door Charge
1—3 Ton SWINDELL Hyd. Top Charge,
1—15 ton SWINDELL—3000 KVA Transformer. Latest type.

FURNACES—INDIRECT ARC
1—10# DETROIT
1—60# DETROIT
1—350# DETROIT LFA
1—750# DETROIT LPY, Conical Shell,
1—1000# DETROIT AAD P, 300 KVA
1—3000# Detroit C, 500 KVA

BEST WISHES
for a
HAPPY HOLIDAY
and a
PROSPEROUS
NEW YEAR

FURNACES—INDUCTION MELTING
1—35 KVA AJAX 60 cy., alum.
1—35 KVA, AJAX SPARK GAP, High Freq., steel
1—1250 KW 2 Ton Cap.
1—5KW G.E. Tube Type Induction Heater
1—30 KW VACUUM Induction Melting Unit
1—30 KW LEPEL, water cooled spark gap

FURNACES—GAS & OIL
1—400# FISHER MNP, Gas Fired. Alum.
2—400# HAUSFELD hand tilt, Oil fired, alum or Magnesium
1—1 #900 JC STROMAN, gas. Like new
1—1200# Brass, MNP, Oil

FURNACES—HEAT TREAT
1—4' x 4' x 10' Gas Fired Annealing
1—9' x 12' Car Type, gas/oil
1—10" x 24" x 60" Gas, double end doors
1—12" x 36" x 8" high HAYES "Certain Curtain"
1—7' Rotary G.E., 200 KW, 1950° F
1—36" x 36" WESTINGHOUSE Pit Type.

MOLDING MACHINES
Jolt Rollover Pattern Draw
1—HERMAN 10.000#, 48" x 109" table
1—HERMAN 6000#, 42" x 78"
2—HERMAN 7500#, 40" x 50" tables
1—HERMAN 7500#, 40" x 60" table
1—HERMAN 3000#, 30" x 66" table
1—HERMAN 3000#, 32" x 70", 15" cyl. series charging conveyor type, turnover plate not jolted
5—HERMAN 1500# to 30" x 48" tables
3—HERMAN 750#, 24" x 30" tables
1—INTERNATIONAL 30" x 12", Type G, 28" x 35" table
2—INTERNATIONAL, 13" x 17" tables
1—OSBORN #442, 21" x 31" table, 600#
1—OSBORN #602, 36" x 26", 900#
1—OSBORN #405, 3000#, flask size 64" x 57", 26" draw
1—SPO #506, 24" x 25" table, 600#
4—TABOR 40" x 60", 1500 & 3000# capacity
2—TABOR 30" x 40" w/air clamps, 1000#
1—TABOR 22" x 42", pattern draw, shockless, portable, 600#
1—TABOR 20" x 30", w/air clamps, 1000#
2—TABOR 14" x 16" Rockover 150#
1—TABOR 40" x 50" table, 3000# capacity
Plain Jolt
2—DAVENPORT, table 24" x 27", 1200#
1—INTERNATIONAL, 3' x 4' table, 12" cylinder
Jolt Pin Lift
1—HERMAN #4317, 22" x 30" table
2—INTERNATIONAL JDP, 1200 x 8", 24" x 26" table, 8" draw, 1200#, port.
1—J & J #681-C, 30" x 25" table, 600#
1—OSBORN #559, 25" x 30" table, 6" draw, 1200#
2—SPO #305, 750 lb., 20" x 27" table
1—TABOR 20" x 24" table, 600#
Jolt Squeeze Pin Lift
2—INTERNATIONAL PKL, 20" x 28" table, 14" sq., 5½" draw
2—INTERNATIONAL PKL, 18" x 24" table, 12" sq., 5½" draw, stat.
1—MILWAUKEE #126, 21" x 27" table, 12" sq., 1200#, 8" draw
2—MILWAUKEE #163, 15" x 24" table, 11" sq., 1500#
1—MILWAUKEE #165, 24" x 30" table, 16" squeeze, 1700#
1—NICHOLLS 18-44, 6½" draw.
5—OSBORN #712J, #712PJ, 18" x 28" table, 12" sq., 6" draw, stat. & port.
5—SPO #2114P, 21" x 27" table, 600#
2—SPO #2116, 21" x 27" table, 11" sq., 6" draw
Jolt Squeezers
2—INTERNATIONAL #12 LJS, 16" x 20" table
4—INTERNATIONAL #10 LJS, 16" x 20"
2—OSBORN #276J, 17" x 26" table, 13" squeeze, 500# port.
10—OSBORN #275J, 16" x 20" table, 400# port.
12—SPO #110J, 17" x 20" table port.
1—SPO #113 J, 18½" x 26" table, 13" cyl., port.
3—TABOR Squeeze-in Head, 16" x 19" table

MATERIALS HANDLING
1—BYERS, Mobile Crane, BUDA Engine, 50' Boom, 5 ton w/magnet & bucket
1—HOUGH PAYLOADER, Model HA, 1000# cap., hyd. lift, mech. dump

MULLERS AND MIXERS
1—B&P #30 Speedmuller w/skip hoist, 3 cu. ft. batch
1—B&P #40 Speedmuller w/skip hoist, 5 cu. ft. batch
1—B&P #7 Mulbaro, 7 cu. ft. capacity
1—B&P #60 Speedmuller, 10 cu. ft. batch
1—B & P, Conventional, SIMPSON type, 87½" Dia. arranged for cooling
1—CLEARFIELD #404, 4' Dia, 4 cu ft batch
1—CLEARFIELD #610, 6' Dia., 10-14 cu. ft. batch
1—SIMPSON #0, U.D. 3' Dia, never used
1—SIMPSON #1, U.D., 4' dia., 4 cu. ft. batch
1—SIMPSON #1½, U.D., 6 cu. ft. batch
1—SIMPSON #2, 6' U.D. Dia, 14 cu ft batch
2—SIMPSON #3, enc. gear, 20-25 cu. ft. batch
1—SIMPSON #3, 8' Dia. Open Gear, 20-25 cu ft batch

LADLES
Bottom Pour
4—MODERN, 49" x 49"
2—MODERN Crane Type, 55" H x 50" top
1—MODERN Crane Type, 60" H x 60" top
Lip Pour
1—WHITING 40" x 40" top dia. geared
Cylindrical
8—WHITING, 26" L x 25" dia, 1100# iron
7—WHITING, 19" L x 22" dia, 600# iron
3—WHITING, 38" L x 28" dia, 2200# iron

OVENS
1—COLEMAN, Gas, 2 Comp. and 5 drawers, O.D. 22" x 12' x 10'
1—GENRICH, Elec., 3 drawer, preheating, auto-control. 9' H x 8' W x 6'7" L
1—GENRICH Electric, Rack Type, 5' W x 7' H x 5'3" L
3—GENRICH, Elec. elevator type, Inspection under operation in N.Y.C.—Excellent Condition

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1—AMERICAN Sand Cutter, Model AA, 62" cutting reel
1—B & P Nite-Gang
2—B & P Screenarator, Model "8" & "M"
1—LINK-BELT Revivifier
1—MOULDER'S FRIEND, 50" cutting reel
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3—ROYERS, NDP, 15-25 tons/hr, 2 Hp
1—SIMPLICITY Type SOBG, 4' x 5' screen

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1—B&P Stationary, Single Speed
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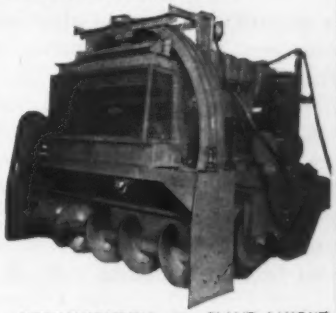

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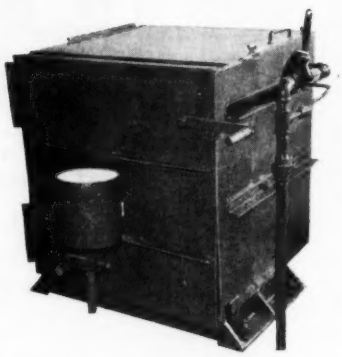

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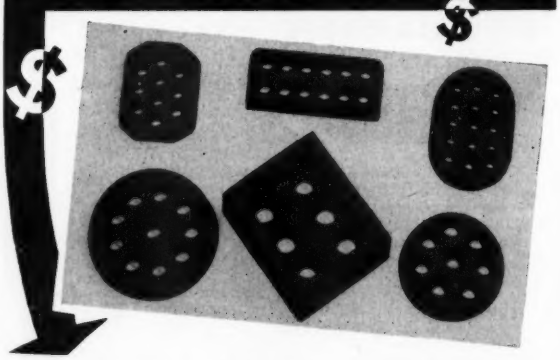

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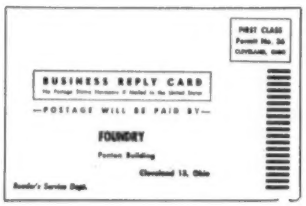

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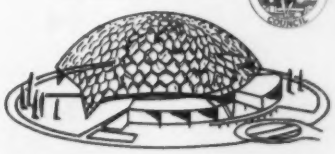

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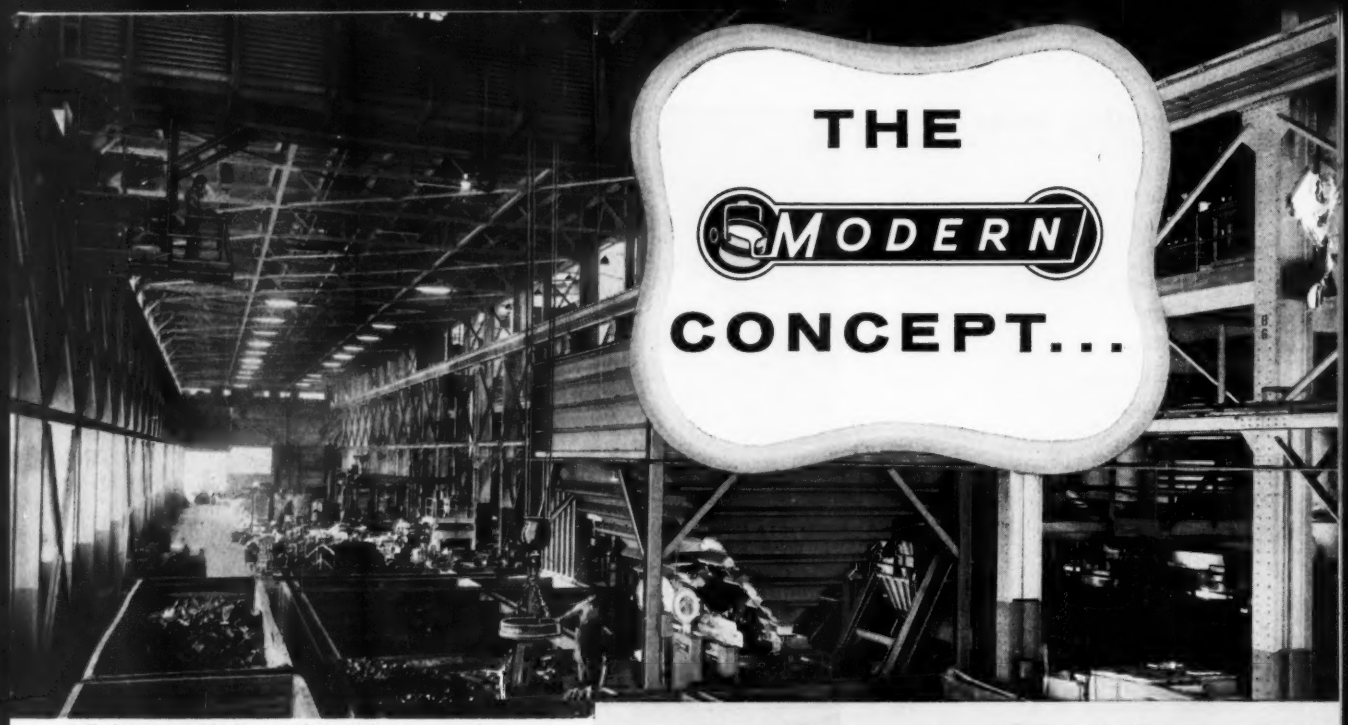
F1

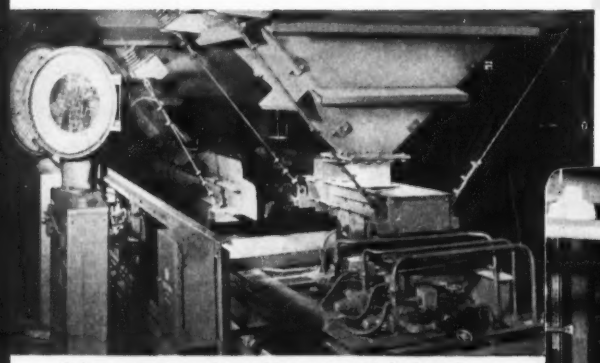
THE MODERN CONCEPT...



Full-size motor blocks are charged by crane and magnet through scale-mounted, weigh hopper to small-cone, orange-peel bucket.

in Cost Cutting!

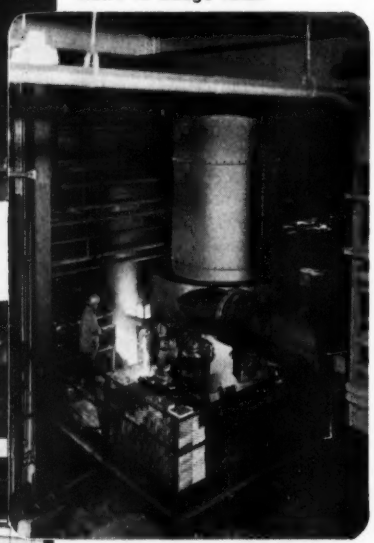
Automization of the charging, melting and pouring cycle may follow set patterns. Still every installation is different:



Coke and stone from bins are weighed and recorded automatically.

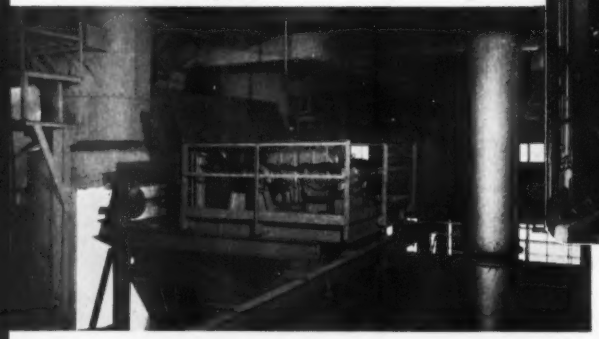
Upper portion of charger indexes to serve more than one cupola.

Slag is granulated in water and flows to sludge tank.

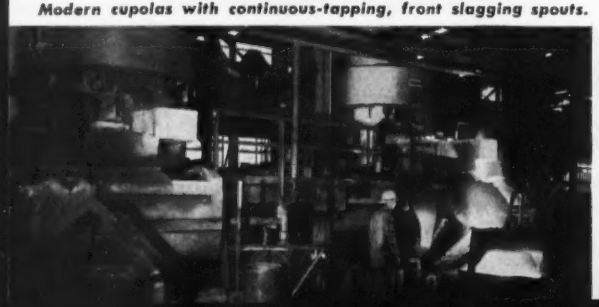


DIFFERENCES IN —

- *lengths of melting time and types of iron may alter cupola designs . . .*
- *cupola locations and yard conditions call for differences in swiveling and indexing of the charger . . .*
- *charging cycles determining the stock bin and feeder equipment.*
- *automatic weighing and recording instruments — inventory the components, eliminate human error and insure uniformity of metal . . .*



Modern cupolas with continuous-tapping, front slagging spouts.



In all these and other ways MODERN's single responsibility for engineering, fabrication and erection is cutting the tonnage costs for the Bullard Company. Other case studies in catalog 147-C . . . *Circle 691 on Page 53*

MODERN EQUIPMENT COMPANY, Dept. F-1, Port Washington, Wisconsin

Mail to my attention:

- ☐ Catalog 147-C on charging and melting . . .
- ☐ Catalog 150 on cranes, and monorail systems . . .
- ☐ Catalog P-152-A on ladles and pouring . . .

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• no blow holes
• no cracks

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Circle 552 on Page 53

EVERYTHING FOR A FOUNDRY

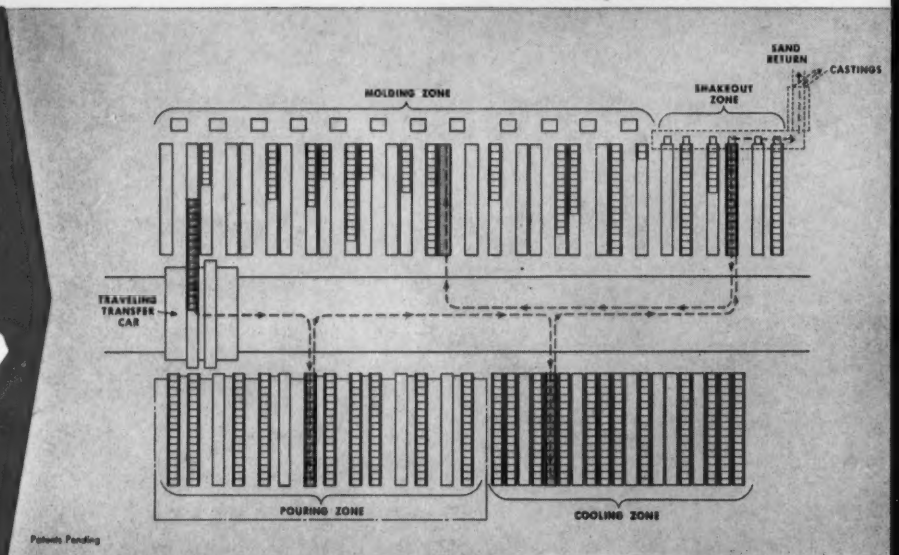
new

BARTLETT B-SNOW

CLEVELAND 5, OHIO

General View Showing Group of Unpoured Molds Being Loaded onto the Transfer Car.

"MF" mold handling system



Patents Pending

provides maximum flexibility in molding, pouring, cooling and shaking-out any size or type of ferrous or non-ferrous mold.

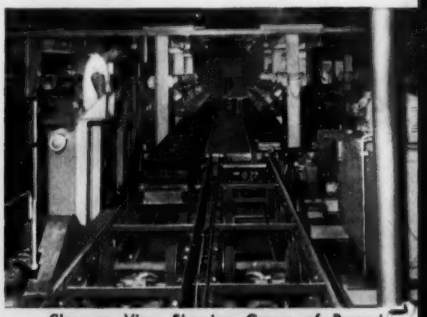
MANY ADVANTAGES

1. Molding, pouring, cooling and shakeout are centralized.
2. Maximum production is obtained from available floor area.
3. Snap and tight flask molds of different sizes can be set out as rapidly as they are made.
4. There is no waiting for set-out space.
5. Slow jobs do not hold up fast jobs.
6. Cooling time can be long or short depending upon the size and type of casting.
7. Sand handling facilities are minimized.
8. Pouring zone is located close to the melting area.
9. Weight and jacket handling are greatly reduced.
10. Ventilation is simplified. Fewer pits are required.
11. High production is obtained with less equipment and less manpower.
12. Handling similar molds together permits pouring different groups with metals of different analysis.

•For more information about this and other modern, cost reducing ideas, telephone your nearest Bartlett-Snow representative.

OPERATION

The RED ARROWS in the diagram above show a typical path of a group of molds on a roller-top pallet as they are moved through a complete cycle by a single operator with a transfer car.



Close-up View Showing Group of Poured Molds Being Loaded onto the Transfer Car.

THE C. O. BARTLETT & SNOW COMPANY

Designers, Engineers, Fabricators and Erectors of Foundry Equipment

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